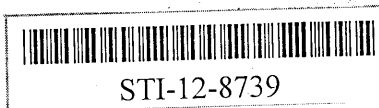


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THE PHILIPPINE JOURNAL OF SCIENCE

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No. 1

PHILIPPINE COAL RESOURCES AND THEIR EXHAUSTION

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ONE PLATE AND FIVE TEXT FIGURES

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The coal fields of the Philippine Islands.	Estimate of coal reserves.
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Classification of coal seams.	Production, importation, and consumption of coal. (Tables 4, 5, 6.)
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INTRODUCTION

The importance of coal in the development of the industries cannot be overestimated. Coal represents the basic energy of civilization, and the future of commerce depends on its supply. Since 1842, when the first ton of coal was taken out of the ground in the Philippines, the coal reserves of the Archipelago have been drawn upon. Every ton mined and sold to consumers means so much less coal in the deposits. Every ton of coal left in the ground on account of poor mining methods and every ton burned by improper use means just so much coal wasted.

Philippine coal consumption averages half a million tons annually. The subject of the present inquiry is the nature and extent of the local supply. It is important to remember that local production amounts to only about one-tenth of the importations. It is desired to call attention to the fact that, while the local coal deposits cannot supply the entire demand, enough local coal can be made available, through improved methods of mining, to stabilize the industry.

THE COAL FIELDS OF THE PHILIPPINE ISLANDS

Coal occurs in all of the larger islands of the Archipelago and in most of the provinces. The following general coal areas are recognized:

The Cagayan Valley field covers that portion of Cagayan Valley from Amulung to Nassiping, about 50 kilometers from Aparri, Cagayan. Coal outcrops have been located near Bagao and to the north of Alcala, and also 25 kilometers to the northeast of Nassiping. Although one of the earliest known coal areas, it has never produced one ton of coal. At one time the coal outcrops were on fire. The coal is of a poor quality, and on this account steamers calling at Aparri have not found it desirable to take part of their coal at that port.

The Cordillera Central field includes isolated patches in Abra, Mountain, La Union, and Nueva Vizcaya Provinces. In Abra coal is found on Malanas River, near the town of Dolores. The Census of 1918¹ records that "traces of copper, coal and iron pyrites have been discovered along the Abra River." In La Union coal is found at Aringay and also, according to Burritt,² in the mountains of Bacnotan. The occurrence of coal in Nueva Vizcaya is reported in a letter of the governor of the province to the Director of the Bureau of Science requesting an examination of the coal deposits in his province. A small seam of coal occurs along the border of Ifugao and Nueva Vizcaya, near Cawayan. In Benguet Subprovince coal outcroppings have been found on Mount Kapangan.

The Zambales Mountains contain scattered deposits of coal. It is reported to occur on the western flank on the northern slopes of Mount Maubanban near San Antonio. However, recent work of V. Elicaño showed Mount Maubanban to be igneous and hence it cannot contain coal. In the vicinity of Candelaria and Santa Cruz coal outcrops have been located.

¹ Census of the Philippine Islands 1 (1918) 75.

² The Coal Measures of the Philippines (1901) 10.

The eastern flank of the Zambales range is apparently devoid of any coal. The reported occurrence of coal in the immediate vicinity of the town of Ayuso, in Tarlac Province, described in Centeno's *Monografías Geológicas*, cannot be verified, as no town of that name can be found in the recent list of Philippine geographical names. Likewise, the reported occurrence of "carbon minerals" near San Miguel, in Pampanga Province, needs verification.

The Eastern Cordillera field includes localities in Nueva Ecija, Bulacan, Rizal, and Tayabas Provinces. Reports of coal outcroppings in Nueva Ecija need confirmation, but deposits in Bulacan, Rizal, and Tayabas have been known since earliest times. Coal in Bulacan occurs in the vicinity of Norzagaray and San Miguel de Mayumo, and also in the mountains of Silao and Santo Cristo. In the region of the Manila water-supply reservation, east of Montalban and San Mateo in Rizal Province, thin beds of coal have been found. In Tayabas a considerable number of coal prospects have been located from time to time, notably in that narrow neck of land between Pagbilao and Atimonan and also in the Pagbilao Islands. A few years ago coal was discovered in the vicinity of Mauban near Ligam River and Mount Batoc-toro. It is quite probable that this coal area extends to the northeast corner of Laguna Province.

The most important deposit in Tayabas Province is on Polillo Island, in the vicinity of the barrio of Burdeos. The coal-bearing formations lie to the west of Burdeos at a distance of from 1 to 6.5 kilometers from Burdeos Bay. The development of this district has not gone beyond the prospecting stage. About 1907 the Polillo Land Company did some development work, consisting of crosscuts and shallow pits in the outcrops. At Guinibauan Creek a small entry was driven a total distance of 21 meters; 100 tons of coal resulted from the development work and were shipped to Manila. In 1908 J. B. Dilworth, of Philadelphia, made an examination of the Polillo coal district, but nothing resulted from his visit. Even during the coal-mining boom of 1920 this district was idle. The coal is bituminous and of very good quality; the principal cause for its nondevelopment has been geologic disturbances of the strata which have made mining difficult and expensive. In Alabat Island a small outcrop has been located near the barrio of Gordon.

Southeastern Luzon and adjacent islands coal field includes a number of well-known districts. In Caramoan Peninsula, along

Caramoan River, about 2 kilometers upstream from the Guijalo-Caramoan road, is a coal outcrop which has been known for at least eighty years. Also, near the barrio of Parubian coal is said to have been found. Across Caramoan Peninsula to the east is Catanduanes Island. Coal occurs in this island a few kilometers north of Virac near the barrio of Cabugao, and also to the north of Calolbon on the southeastern part of the island. To the south of Catanduanes are Cacararay, Batan, and Rapu-Rapu Islands. Practically the whole of Batan Island is underlain with coal. Liguán, Caracaran, Calanaga, and East Batan are the important mining districts. The coal-bearing area of Batan Island is estimated at 34 square kilometers.

Coal mining in Batan Island began in 1842 when the then governor of Albay, Juan Velarde, worked the large open deposits of Calanaga and shipped the production to Manila. During the following fifty years the major part of the work done in this district was location and relocation of claims. In 1904 the United States Army reserved the western end of Batan Island and began development work. The exploratory work consisted in part of drilling; however, the results of the drilling were very confusing and difficult of interpretation. The mine workings yielded more information, particularly those at the so-called Big Tree and New Number 5. In 1909 approximately 2,500 meters of galleries were opened up. The undertaking was not much of a success, and in January, 1911, all the mines and workings were abandoned. In July, 1921, the military authorities turned the property over to the Civil Government which leased it to E. C. Walters on December 15, 1921. N. T. Hashim succeeded E. C. Walters, and the Liguán Coal Mines, Incorporated, was formed, to undertake the development of the property. Some of the old workings of the army have been reopened and the company has ambitious plans for the future. A modern pier has been built, and interisland steamers coaling at Liguán have been able to load at the pier. The coal is of very good quality and finds a ready market.

In 1905 the East Batan Coal Company on the eastern end of the island commenced extensive development work. In 1909 the workings of the company consisted of 6,096 meters of galleries with a main entry of 295 meters. In 1910 the main slope reached a total distance of 550 meters and the face of the workings was approximately 50 meters below sea level. The mine produced consistently for five years, and then reverses came. In May, 1911, the company went into the hands of a receiver.

The failure of this company was due to several factors. In the first place too much money was spent for the surface plant and comparatively little on development work. Then, one of the slopes penetrated loose broken ground and salt water began to come in. In a short time the whole mine was flooded. The East Batan Coal Company was one of the few mines in the history of Philippine coal mining able to produce from 20,000 to 30,000 tons annually for several years. It is to be regretted that the company lasted only five years. The property was afterward sold to the Government to satisfy its indebtedness.

The Philippine Coal Mining Company started operations in 1917, also on eastern Batan, at a place about 2 kilometers from the East Batan Coal Company property. This company produced consistently until 1921, when it went into the hands of a receiver. During the early part of 1921 it produced between 300 and 500 tons a day. At present the property of the Philippine Coal Mining Company is in the hands of the Philippine National Bank. There are persistent rumors that the bank has subleased the area to E. J. Haberer, who is getting a little coal from one of the abandoned workings. The Albay Gulf and Pacific Company did some development work and produced some coal from the property west of the Philippine Coal Mining Company. At the present time A. U. Betts is operating near the barrio of Dapdap. He has driven three tunnels on the strike of the main coal seam, and is driving his rooms up and down the dip. The East Batan coal is principally lignite but finds ready sale among the interisland steamers.

The old Minas de Batan on the northeastern portion of the island near Calanaga Bay were worked by a Spanish company during the early days of American occupation. Considerable money was spent, but the production was small and the company finally went bankrupt. Japanese miners next took up the property, but their methods were crude and wasteful, and the production was small. Later, in 1923, the Calanaga Coal Mining Company did some development work and was able to produce some coal. At one place a pocket of coal more than 40 meters thick was encountered. Near Caracaran, in the middle of the island, on the opposite side of Calanaga Bay, J. E. Barker had several shafts and tunnels. In April, 1925, the activity in this central district was confined to near Calanaga Bay, where the Strittmatter-Karolchuck Coal Mining Company is doing some development work. Cacraray is known to contain coal, but the exact locality is not known. On the mainland of Luzon,

in Camarines Sur, coal is reported near Pasacao and in the Ragay hills about 9 kilometers southwest of Bato Lake. North of the lake, in the vicinity of the town of Nabua, coal is also found. In Sorsogon coal occurs in the Sugod district, about 5 kilometers southeast of Bacon. This was one of the more important coal districts. The history of coal mining in this district was described by Pratt³ as follows:

About the year 1874 an association called "La Paz" was organized to exploit certain deposits of coal which outcrop in the vicinity of San Esteban, a barrio of Bacon, Sorsogon. The outcrops appear to represent several beds, but the principal work was confined to a single bed, which, according to José Centeno, an engineer in the Spanish mining inspectorate, varied in width from 4 to 8 meters. All of the beds are nearly vertical and strike about north 20° west. The coal lies near the base of the Tertiary sedimentaries, and at the western edge of the sedimentary area—below the coal—there are outcrops of holocrystalline rocks which probably are part of the base upon which the beds were laid down.

The workings executed by the La Paz association, according to Centeno, included 6 shafts varying in depth from 22 to 34 meters and 5 galleries and crosscuts aggregating 66 meters in length. Ramon Marty, an engineer employed by the company, states that 130 meters of gallery were driven at a level 11 meters below the surface and 188 meters of gallery at a level of 24 meters below the surface, beside the 6 shafts mentioned by Centeno. No faults were encountered, but the width of the coal varied from 4 to 8 meters, and there were zones near the surface in which the coal was broken and contaminated with fragments from the walls. Marty observed that the deepest workings were in good, solid coal and concluded that the broken condition of the coal was superficial only.

The coal was considered to be of excellent quality, 200 tons of it having been used for steaming tests by the Spanish navy. It was admitted, however, that the fuel tended to disintegrate, or slack, upon exposure. Both Centeno and Marty thought that mining could be carried on successfully and expressed no doubt as to the adequacy of the tonnage probably available. Nevertheless, very little was accomplished subsequent to the date of the reports quoted above. The company, La Paz, failed, apparently because of a lack of capital, and the mines were abandoned.

I visited the old mines in 1910, and while nothing remained of the former workings I found several outcrops, upon one of which a short tunnel had recently been driven. This bed is vertical and strikes north 20° west; its full width was not revealed but must exceed 2 meters. The tunnel was about 10 meters long and entirely in coal, neither wall being exposed. The coal appeared to be much contaminated with clay along fractures and in inclosed blocks or horses.

It may be concluded that the coal at San Esteban (designated variously as the Gatbo coal, the Sugud coal, and the Bacon coal) shows evidence of faulting in the broken condition of parts of the beds. The variation in width, also, may be due to the movements which caused the faults

³ Philip. Journ. Sci. § A 10 (1915) 290-291.

or it may be due to irregularities in deposition. The testimony of the Spanish engineers that conditions improved with depth suggests that faulting, not irregular deposition, is really the cause of the nonuniformity encountered, and the exploration so far as it goes indicates persistent coal beds.

Since the failure of the La Paz nothing has been done in this district, and at the present time not even a revocable permit for coal prospecting has been applied for for the area.

The Visayan Islands coal field comprises isolated areas in Masbate, Panay, Negros, Samar, Leyte, Bohol, Dinagat, and Siargao Islands. Cebu is purposely omitted from this list, as it deserves consideration by itself.

The best-known area in this field is the Cataingan deposit near the lower end of the eastern prong of Masbate Island. The area is estimated to be about 5 square kilometers. Work on this deposit started in 1887, and desultory mining was carried on until 1895; a total production of 625 tons was reported for the whole period. The work done consisted mainly of open cuts along the outcrops, and no regular system of mining was followed. The production was hauled over a distance of 15 kilometers on the backs of carabaos to Cataingan, where it was stored and sold to the steamers of *Compañia Maritima*, which called there for cattle. Shortly before the American occupation an English engineer made an examination of the mines, but nothing resulted from this visit. During the insurrection against the Americans the insurgents took out a small amount of coal from the place for use in their launch. Since American occupation the district has been visited by prospectors, but up to the present no work has been done on these coal deposits.

In Panay coal is known to occur near Buruanga and is reported from north of Libacao and Balete, in Capiz Province. In 1920 a few revocable permits were issued for coal prospecting around Buruanga, but the work did not go beyond the prospecting stage. According to Abella, coal is also known from Valderrama, which he places in Capiz Province but which is near the western shore of the island and is in Antique Province. The same authority noted the occurrence of coal in Dingle in Iloilo Province. The Bureau of Education reports that thin coal seams have been discovered at the nearby town of Janiuay.

In Negros the deposit near Calatrava and Talabe on the north-eastern part has been known since Spanish times. From 1874 to 1899 several expeditions and entries had been made in this district but there was no development. At the northern end of

the island, near the barrio of Salamanca, Escalante, coal has been discovered and this was the subject of an investigation in 1918. In the southwestern part, to the east of Cabancalan, occurrences of coal have been reported but no detailed information can be had.

Samar's coal deposits are little known. The reported occurrences are at Centeno's locality Loquilocon and at Gandara and Paranas, as recorded by Abella. Loquilocon is about 11 kilometers northeast of Paranas, which is now called Wright. During the Philippine Carnival of 1918 Samar Province exhibited samples of lignite said to have been collected from a locality 11 kilometers southeast of Wright.

In the neighboring island of Leyte coal is said to have been found, according to the Census of 1918, in the towns of Leyte, Ormoc, and Jaro. Near the northern end of the island, in the municipality of Babatngon, coal is also found. Burritt recorded the occurrence of coal in the town of Hagna (probably Jagna, in the neighboring island Bohol), on the southern coast, and the Bureau of Education noted the existence of a small amount at Calape on the eastern coast.

In Dinagat Island coal is reported at Tubajon, Mabuá, and Aliton, the last two localities not shown on any of the maps available. Recent work of V. Elicaño showed the occurrence of coal within the municipality of Loreto.

In Siargao the reported occurrence is in the vicinity of the town of Dapa. According to Becker coal also occurs at Numancia on the west coast and at Cabantug on the east coast.

The Bureau of Education records the existence of coal at Hinatuan Island. According to V. Elicaño, this island is volcanic, and the town of Hinatuan on the eastern coast of Surigao is probably the locality meant.

Cebu Island contains a number of well-known coal districts. The coal-bearing area extends from Sogod and Asturias on the north to Boljoon and Malabuyoc on the south. The most important districts, however, are Cajumayjumayan, Compostela-Danao, and Uling. The Cajumayjumayan coal district lies north of Sili peak and Lantauan ridge. The Compostela-Danao, lying just to the south of Cajumayjumayan, consists of Masaba, Mantija, Camansi, and the area west of Mount Licos. The Uling coal district extends from a point on Mananga River known in the literature as Guila-Guila, west to Toledo and southwest to Alpaco; Mount Uling is in the center of this district. The complete history of the discovery of coal and coal mining in Cebu is

given by Burritt in *The Coal Measures of the Philippines*, which is a compilation and translation of records obtained from the Spanish Inspección General de Minas. The following is a summary by Smith⁴ up to 1908:

Coal was discovered in Cebu in 1827. The first concessions in the Compostela-Danao region were solicited by Isaac Conui in 1871. A wagon road was built from Cot-cot cove to the workings at Dapdap in 1877. The formation of the association known as the Sociedad Nuevo Langrea and the beginning of actual work took place about 1890. The construction of a tramroad from Danao to Camansi, and from Compostela to Mount Licos, was undertaken in 1895. The Spanish-American war in 1898 occurred. In this year all the concessions in this district came into the hands of Mr. Enrique Spitz. These have changed hands again and are controlled by the Insular Coal Company, which is now in the field carrying on exploratory work.

In 1907 and 1908 two companies were engaged in vigorous exploration of this field, the Insular Coal Company in the Mount Licos and Camansi region and a New York syndicate in the Cumayjumayan Valley, but there has been no further work. It is understood that negotiations are under way for the formation of a large company to mine this coal in the very near future.

In October, 1912, Camansi was visited by a severe typhoon, which destroyed part of the railway and buildings. This brought operations in the district to a temporary halt and it was not until about 1917 that a new company, the Danao Coal Mining Syndicate, commenced driving tunnels and sinking shafts, not only at Camansi, but also at Masaba and Mantija. This company changed hands in 1922. In 1924 there were persistent rumors that the new owners were supplementing their exploratory work by hand drilling, using Chinese labor especially imported for the purpose. Underground development work has also been carried on, and the workings have been producing some coal. A 12-kilometer tramway connects the mines with the Philippine Railway Company at Danao.

The Camansi district has been honeycombed with tunnels, drifts, shafts, and *paquiao* workings. At one time, according to reports, the mine workings aggregated several thousand lineal meters and some 10,000 square meters of rooms.

Development in Mount Licos district began in 1918 when the National Coal Company acquired the property by lease. Several tunnels were driven, but in November, 1925, the bulk of the production came from No. 8 slope, which was driven approximately halfway between the north and the south boundaries of the prop-

⁴Mineral Resources of the Philippine Islands for 1909 (1910) 39.

erty. The main entry was driven on the strike of the Abella seam. Late in 1923 the main entry struck an east-and-west fault, which is about 500 meters north of the main opening and has been known since Spanish times as the general fault. After driving through 70 meters of rock coal was again encountered; the strike of the seam, however, changed and curved until it assumed the form of a fishhook.

Transportation in the Mount Licos coal district is by means of a 4-kilometer aerial cable tramway from Licos to Basak and by a spur of the Philippine Railway Company from Basak to Compostela.⁵

Coal-mining operations in the Mount Uling district commenced about 1860. The most important work was that by Doña Margarita Roxas, who had a tunnel driven at the base of Mount Uling near the junction of two streams. This tunnel reached a length of 649 meters and, according to the records of the Spanish inspectorate, struck a large seam of coal. However, Doña Margarita died soon afterward and her work was allowed to fall into ruin. She also carried on exploration work at Lutac and Alpaco. She constructed a 15-kilometer mountain road from Uling to Alpaco which was used to transport her production to the sea coast. In 1913 some systematic exploration work was done in the district under the direction of the division of geology and mines of the Bureau of Science. In 1915 a tunnel was driven at a higher elevation than that of the tunnel of Doña Margarita Roxas, under the supervision of Wallace E. Pratt, formerly chief of the division of geology and mines, and coal was reached at 121 meters. A slope was then driven on the dip and carried 98.4 meters, when the old workings were encountered. In 1920 another tunnel was driven near the mouth of the old Doña Margarita tunnel and at about the same elevation. On account of several interruptions this tunnel, at present known as Doña Margarita No. 1, was driven only 471 meters and did not reach coal.

Production from this district was resumed in 1917 when Bryan and Landon commenced to supply the Cebu and Iloilo electric plants with coal from their Mount Uling coal workings. The Uling-Naga Coal Company, successors to Bryan and Landon, has several tunnels driven at right angles to the strike of the coal beds, and has done important development work. At the

⁵ The National Coal Company stopped operations in this district in April, 1926, and the tram line was dismantled and all mine equipment sent to Malangas, Mindanao.

present time (June, 1925) the Cebu Portland Cement Company is diamond drilling the area for the purpose of determining the amount of workable coal contained in the property with a view of purchase.

Near Toledo the Toledo-Cebu Coal Mines, Incorporated, is doing some development work and has been producing a small amount of coal. At Cantabaco, on the banks of Masaba Creek, where in 1920 there were numerous paquiao workings, only Quintin Rivera is doing a little work.

The activities in the other districts will be briefly mentioned here. Guila-Guila, in Mananga Valley, was worked by the Spanish about 1853. In 1909 Mr. Mitkiewicz did some development work, and in 1920 the Toledo Coal Mines had some paquiao workings; the production from this district was small. Dalaguete district, in the southern part of the island, had a number of paquiao operators and contributed a small amount to the total coal production.

The Mindoro coal field includes the deposit on the southeastern part of Mindoro Island near Bulalacao, and that of the neighboring island of Semirara to the south. The Mindoro coal is subbituminous and the seams are reported to be from 1 to 4 meters in thickness. Becker, on the authority of Centeno, wrote that the outcroppings on Semirara are between high-water and low-water marks. Espina reported the occurrence of coal at Subaang on the north coast of Mindoro, but gave no details. A rather careful and extended examination of the Bulalacao coal district was made in 1898 by Fenton W. Hill. Two tons of coal were secured from outcrops in the area and tested on the steamer *Bolinao*. The results of the test were satisfactory and Hill concluded that the property was a valuable one, but up to the present time nothing has developed.

Mindanao contains a number of coal localities, but with the exception of the Sibuguey district they have not assumed much importance and little is known of them. On the eastern coast coal is known from Bislig, Marihatag, Tarragona, Mati, Lanuza, and Hinatuan; also at a point on the southern coast said to be latitude $6^{\circ} 4'$ and on the same meridian as Iligan. Coal is also reported from Naanán, a few kilometers north of Iligan. In Agusan coal is known at Jabonga, San Vicente, and Bunauan. The reported occurrence of coal around the volcano of Camiguin in Misamis Province is extremely doubtful. Other coal localities are near Siacon in Zamboanga and at Craan in southern Cotabato. The Sibuguey district comprises the coal

areas at Butong, Gotas, Lumbog, Dumaguete, Camp Wilmot, and nearby localities. The district is located about 144 kilometers northeast of Zamboanga. The coal from Butong is semianthracitic, high carbon bituminous, and subbituminous.

The first record of coal from the Sibuguey district is contained in two reports, dated 1855 and 1856, from a commission under the direction of the commandant of engineers at Zamboanga. This report states that 36 tons of dirty coal were obtained from Mount Marasigan, by one hundred prisoners in seventeen days. It is very probable that the expedition obtained this coal from the vicinity of Siay River district, as some of the old Spanish maps show coal in that vicinity. Williams and Redding did some desultory mining on Sibuguey River in Ganyangan district and, according to reports, tried to ship 10 canoes (*lankons*) of coal on Sibuguey River to Sibuguey Bay. Unfortunately, seven of the canoes capsized in the river and only three reached the bay. In 1907³ J. O. Cleveland did some prospecting in Manabing district and produced a small amount which the Subanos carried in sacks to the coast. In 1917 the National Coal Company was organized and the Civil Government reserved the entire Sibuguey coal field for the scene of its operations. The first attempt to produce coal was at Payao, during the latter part of 1917, and the company tried to follow the method of Williams and Redding of transporting coal by way of Sibuguey River by means of scows. Several cascos were bought but, after the river was cleared, it was found that the water in the river was not deep enough for loaded scows. The following year the scene of activities was transferred to Malangas, where a 12-kilometer railroad, a wharf, coal bunkers, and loading equipment have since been constructed.

The Butong deposit is worked by a shaft sunk on the top of a dome structure. At Gotas the company has done some development work, while at Lumbog the present production comes from paquiao workings. The production of Gotas and Lumbog is trammed by hand to the foot of an incline, where it is pulled to the top of the flat ridge separating the district from Butong. Then the coal is trammed again across to Butong where the railroad cars await it. At the present time some paquiao work is being done at Camp Wilmot.

ESTIMATE OF AREAS AND TONNAGE OF COAL IN THE PHILIPPINE ISLANDS

The first attempt to estimate the areas and tonnage of coal in the Philippine Islands was made by F. A. Dalburg, in the

Mineral Resources for 1911, when he presented the table which is here reproduced as Table 1.

TABLE 1.—*Estimate of areas and tonnage, Philippine coal fields.*

Field.	Class of coal.	Coal seams.		Tonnage in metric tons.			Coal lands (areas actually containing merchantable coal).	Coal lands (areas probably containing coal).	Coal fields (areas possibly containing coal).
		Number.	Thickness.	Actual.	Probable.	Possible.			
			Meters.				Sq. km.	Sq. km.	Sq. km.
East Batan.	Lignite (black).	2	1.5	3,340,000	20,960,000	Moderate.	2.0	5.00	15.5
Liguan.....	Subbituminous.	8	^a 10.5	61,600	216,000	Small.....	0.3	0.60	5
Calanaga.....	Lignite (black).	4	^a 5	-----	2,560,000	Moderate.....	-----	1.25	13
Cajumay-jumayan.	Subbituminous.	4	^a 9	-----	14,592,000	Small.....	-----	2.50	5
Camansi.....	do.....	4	^a 5	-----	4,505,600	do.....	-----	1.25	15.5
Mount Licos.	do.....	4	^a 4.5	-----	5,352,000	do.....	-----	1.25	23
Uling.....	do.....	3	^a 8	800,000	4,992,000	do.....	0.3	1.25	13
Burleqs.....	Bituminous.	2	1.2	-----	1,331,200	do.....	-----	0.30	18
Cataingan.....	Subbituminous.	3	1.5	-----	612,000	do.....	-----	0.60	5
Sibuguey.....	Bituminous.	2	2.5	-----	3,628,000	do.....	-----	0.60	5
Bulalacao.....	Lignite (black).	6	^a 12	-----	4,096,000	do.....	-----	0.30	8
Sugud.....	Subbituminous.	3	^a 5	154,000	-----	do.....	0.1	5.00	10

^a Total.

In this table Dalburg included—

all coal of economic value in seams containing not less than 30 centimeters of merchantable coal and situated within a mineable depth; that is, not more than 1,220 meters below the surface. The quantities are stated as: 1, Actual tonnage, based on a knowledge of the actual thickness and extent of the seams; 2, probable tonnage, based on an approximate estimate; and 3, possible tonnage, for which an estimate in figures can not be given.

For the purposes of the present paper another estimate is made, based on minable seams, which should not be less than 30 centimeters in thickness, containing merchantable coal and occurring at a depth not greater than 300 meters below the surface. From our present knowledge of conditions Philippine coal seams less than 30 centimeters in thickness and at greater

depths than 300 meters below the surface cannot be profitably mined.

In Table 2, in the column showing the number of coal seams, are given only those that have been actually worked. The areas of the coal-bearing formations in the more-important districts are given and an estimate is made as to the portion probably productive. In estimating the original tonnage the peculiar depositional conditions of Philippine coal have been considered.

TABLE 2.—*Estimate of areas and tonnage, Philippine coal fields.*

Field.	Coal seams.		Area of coal-bearing formations.	Probably productive.	Tonnage.	Total production to 1924.
	Num-ber.	Thick-ness.				
		Meters.	Sq. km.	Per cent.	Metric tons.	Metric tons.
Cagayan Valley.....	2	0.5-1.0	6	5	100,000	-----
Cordillera Central.....	-----	-----	-----	-----	-----	-----
Zambales Mountain.....	-----	-----	-----	-----	-----	-----
Eastern Luzon and Polillo.....	-----	-----	-----	-----	-----	-----
Burdeos, Polillo Island.....	3	0.6-1.5	18	15	1,000,000	100
Southeastern Luzon and adjacent islands.....	-----	-----	-----	-----	-----	-----
Batan Island.....	4	0.3-1.7	34	50	5,800,000	144,382
Sugod, Sorsogon.....	3	3.0-8.0	16	30	1,600,000	200
Visayan Islands (except Cebu).....	-----	-----	-----	-----	-----	-----
Cataingan, Masbate.....	3	0.7-2.0	5	10	200,000	623
Cebu:	-----	-----	-----	-----	-----	-----
Cajumayjumanayan.....	4	0.5-3.75	6	50	2,500,000	-----
Compostela-Danao.....	4	0.5-1.6	42	25	3,400,000	118,233
Uling.....	5	0.3-4.5	14	50	2,400,000	91,223
Other districts.....	-----	-----	-----	-----	-----	385
Mindoro.....	6	1.0-4.0	9	25	800,000	2
Sibuguey, Mindanao.....	3	0.3-2.5	51	20	3,400,000	57,182
Total.....	-----	-----	-----	-----	21,200,000	412,280

The difference in the total tonnage as given in Tables 1 and 2 can further be explained by the fact that in Table 2 only the main seam has been considered. Philippine coal seams do not extend over great areas, and not one seam can be traced over great distances. While in one locality four seams may be present, in another locality, not very far distant, in the same coal area, none may be found. It has been deemed convenient for purposes of the present paper to consider only one seam underlying a coal area and to assume that the other seams will compensate for those areas under which all the seams have either petered out to nonminable thickness or have disappeared entirely.

The total production of each of the coal districts up to and including 1924 is given in order to show how much work has been done on them. It is desired to call attention to the fact that losses in mining are not included in the figures, and therefore the amount does not represent total number of tons forever lost.

THEORY OF COAL FORMATION

It is common knowledge that there are two opposite theories to account for the formation of coal beds; namely, the "in situ," or "peat bog," theory and the "drift," or estuary, theory. In the in-situ theory it is held that coal has resulted from vegetation which grew in the place where it is now found, while the drift theory claims that plants were drifted to great distances and deposited at the mouths of rivers. It is held that either the in-situ theory or the drift theory, taken by itself, fails to explain the formation of most of the coal fields of the world; but a combination of the two will probably explain all the phenomena attendant upon the formation of coal. It is also believed that the coal regions were at one time a part of the sea and that the accumulations of vegetable matter occurred along the shores.

It is known that peninsular and archipelagic conditions have existed in the Philippine Islands since the early Tertiary. The irregular coast lines of some of the islands gave rise to inland bays and swamps, and arms of the sea extended far into the interior of the land. Given a mild tropical or subtropical climate, more or less humid, conditions were favorable for the profuse growth of plants and trees. It was in these small basins, more or less irregular in form and outline, that the material necessary for the formation of coal beds accumulated. Underclays, which are claimed by some observers to be essential to the growth of luxuriant vegetation, have been found under some of the seams. The lowest seam in the Compostela-Danao district of the Cebu coal field has a fire-clay floor. It will be recalled that one of the arguments of the exponents of the in-situ theory is the almost invariable presence of fire clay underlying the coal seams. The lowest coal seams were probably formed from plants and trees, growing in place in accordance with the peat-bog theory. Slight subsidence followed, during which the accumulation of vegetable material was covered by a deposit of silt and sand. A period of quiescence succeeded this period of subsidence, at which time masses of

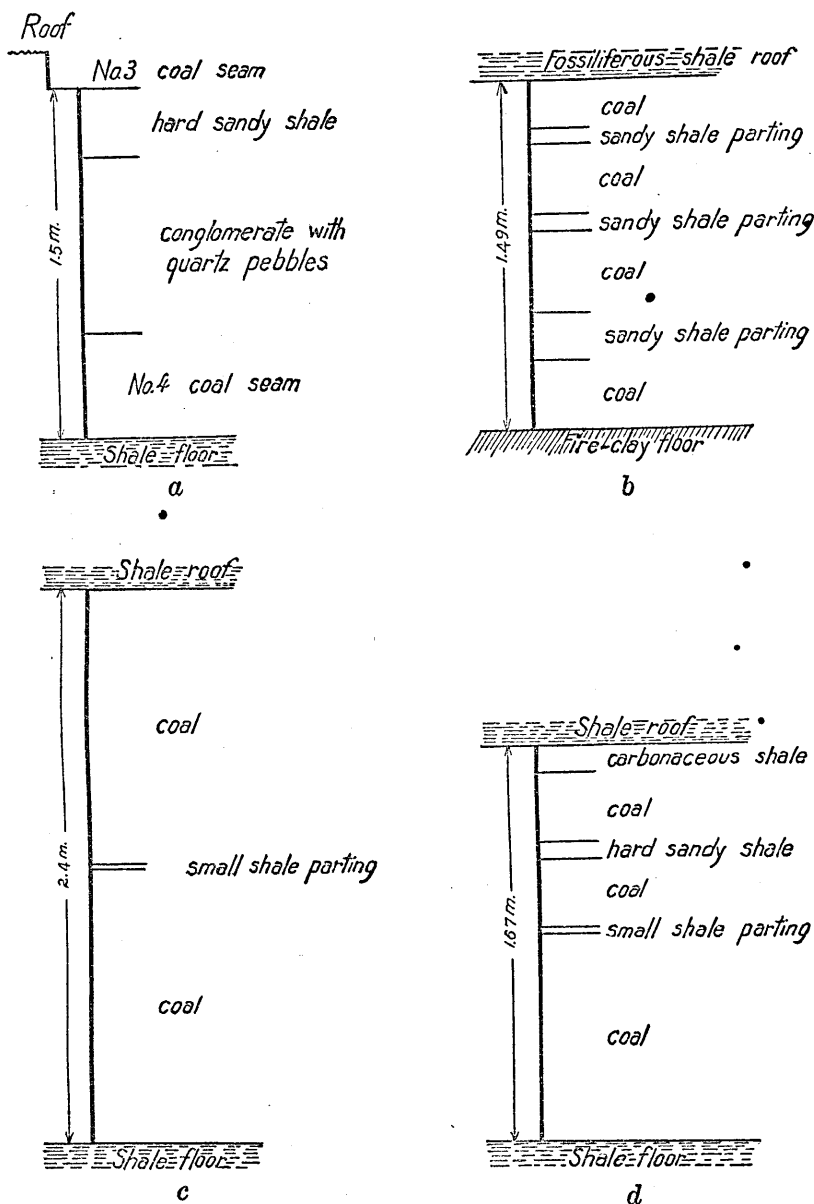


FIG. 1. Sections from different coal mines: a, 11 meters from station 2, tunnel No. 7, Liguian coal mines, Batan Island; b, face of tunnel No. 1, Betts's mines, Batan Island, September 19, 1924; c, average section of big seam, west tunnel No. 3, Uling-Naga Coal Co., Mount Uling coal district, Cebu, May, 1925; d, face of side entry No. 6, water-level tunnel, Gotas, Sibuguey, Mindanao, January 21, 1925.

water-logged drift brought down by rivers were deposited, which provided materials for a coal deposit. Similar oscillations of sea level and periods of comparative rest for the earth's crust following can be held to account for most of the coal seams later formed.

In the Mount Licos area of the Compostela-Danao district there are four seams; namely, the Carmen, the Esperanza, the Abella, and the Enriqueta, named in the order from lowest to highest. One of the reasons for belief in the drift, or estuary, theory is the presence in the roof of marine strata. In the roof of the Esperanza seam marine fossils are found. The floor of neither the Esperanza, the Abella, nor the Enriqueta is fire clay. It is, however, true that all these three upper seams have pretty pure coal, which is one of the arguments for believing that deposition occurred in situ; but it should be borne in mind that we have only small basins, and that the source of material was not far distant and the transported sediment small. Another reason for believing in the drift theory is the presence of prostrate tree trunks. In one of the workings of the Liguán coal mines in the Batán Island coal district a prostrate tree trunk has recently been found in the so-called seam No. 3. This seam No. 3 occurs above the lowest coal seam in the area. Again, in the Uling district of the Cebú coal field, near the town of Toledo, in one of the workings of the Cebu Coal Mines, Incorporated, the lowest coal seam lies immediately on the basal igneous rocks.

The foregoing testimony seems to point to the conclusion that the lowest seams were formed in situ, whereas the upper seams consisted for the most part of transported material deposited in a slowly subsiding area.

On account of the very nature of conditions (namely, the peninsular and archipelagic character of the land masses), the formation of extensive coal areas cannot be expected. The areas are comparatively small in extent and the basins irregular in form and outline.

CLASSIFICATION OF COAL SEAMS

A tentative stratigraphic chart, showing in general the classification and the names of the most-important coal seams found in the Philippine scale, is here presented. It must be remembered that the correlation is tentative and subject to revision.

When the classification of coal seams was first attempted in the United States in the Appalachian region in the limited states the coal seams were named alphabetically in the order of their occurrence beginning with the lowest in the scale. For Ohio coals the same order was adopted but they were named numerically instead of alphabetically, from the bottom upward. On account of the peculiar conditions attending the deposition of Philippine coals, which resulted in the formation of small, widely scattered and disconnected areas, the preparation of a general stratigraphic chart is beset with difficulties. In the Liguian district of Batan Island the seams were numbered from top to bottom; in Mount Licos of the Compostela-Danao district of the Cebu coal field the coal seams were given proper names, while at Camansi, some 4 kilometers to the north, both proper names and numbers were used; in the Sibuguey district of the Mindanao coal field the coal seams are not referred to by any special names or numbers.

In Smith's *Geology and Mineral Resources of the Philippine Islands*^o attention was called to the similarity between the Enriqueta seam of Mount Licos, Cebu (the thickness of 1.2 meters and 5 to 7 centimeters shale parting about 45 centimeters from the roof); No. 5 of Camansi, Danao, Cebu; a seam in tunnel No. 14 at Gotas, Sibuguey district, Mindanao; and a seam on East Batan which measures 1.67 to 1.75 meters in thickness with a shale parting of 7 to 12 centimeters about 55 centimeters from the roof. Owing to geologic conditions, these seams cannot be parts of a continuous bed from southeastern Luzon to southwestern Mindanao; but the similarity is very suggestive of similar depositional conditions. It will be remembered that in correlating coal seams several methods are used. Of these methods the palæontological is the most convincing, wherein a bed is identified by a certain fossil or an association of fossils. Another method is the comparison of the coal and associated strata. Still another method, which has gained considerable prominence during the last few years, is by examination of thin-ground sections of coal under the microscope. The present tentative correlation is based on the evidence of the well-defined top coal above the rather persistent shale parting. The thickness of the top coal, the shale parting, and the bottom coal is fairly uniform in the three fields. The seams exhibit the same mining characteristics; namely, the

^o Bureau of Science Pub. No. 19 (1924) 379.

top coal is strong and can be left to protect the roof from caving in, while the bottom coal contains minor impurities such as bone, shale, or resin that are not easily removed in mining.

If the above-mentioned seam is taken as a key bed, all the other seams occurring either above or below can be named with reference to it, and a classification of the Philippine coal seams is possible. It is proposed that the Philippine coal seams be named alphabetically in the order of their occurrence, beginning with the lowest in the scale. According to this classification the lowest Philippine seam is named A, the next higher B, and so on. Table 3 shows the names and the position of the coal seams in the different coal fields.

TABLE 3.—*Stratigraphic chart, showing some Philippine coal seams.*

Period.	Series.	New names.	Old names.				
			East Batan.	Mount Licos, Cebu.	Camansi, Cebu.	Sibuguey, Mindanao.	Thickness of seam.
Oligocene(?)	Batan.	E		Pilarica.	San Luis.		<i>Meters.</i> 1.4
		D	"East Batan."	Enriqueta.	No. 5.	"Gotas."	1.2-1.75
		C		Abella.	No. 2.		1.00-1.50
		B		Esperanza.	No. 3.		.50
		A		Carmen.	Carmen.		1.6

COAL SEAMS MINED

As many as eight seams of coal have been recorded in the Philippine Islands, but only in five is coal mined in greater or less quantities. Several thin seams of about 30 centimeters in thickness are mined, but these are mined along their outcrops and the workings do not extend to any great depth. The seams in the regular mines are about a meter or more in thickness.

In the Batan district there are three minable seams. In East Batan the coal is lignite, while at Liguán it is subbituminous. At Caracaran near the center of the island the coal is also subbituminous, but at Calanaga both subbituminous and lignite are present. The thickness of the mined seams varies from 30 centimeters to about 4 meters.

Near Burdeos, Polillo Island, the minable seams are three, and they vary in thickness from 60 centimeters to 1.5 meters. The coal is of bituminous rank.

At Sugod, Sorsogon, there are three minable seams. These range in thickness from 3 to 8.5 meters, and the coal is of subbituminous rank.

In southeastern Masbate, near Cataingan, three distinct seams occur, which vary in thickness from 1 to 1.5 meters. The coal here is also of subbituminous rank.

Cebu has the greatest number of minable coal seams in any one district. In Cajumayjumayan there are four seams, ranging in thickness from 50 centimeters to 3.75 meters, while at Camansi near Danao mining has been carried on in five seams; the smallest seam is 50 centimeters and the largest 1.5 meters. On Mount Licos, near Compostela, five seams are present and these vary in thickness from 50 centimeters to 2.7 meters. At Guila-Guila the Spanish Government carried on mining in a seam of coal which varied in thickness from thin layers intercalated with rock to 1 and 2 meters. In the Mount Uling district mining has been carried on in five seams, ranging in thickness from 30 centimeters to 4.5 meters. The coals of Cebu are all of subbituminous rank.

Six minable seams have been claimed for the Bulalacao district in southeastern Mindoro, but these need verification. They are recorded as varying from 1 to 4 meters in thickness. The coal is of subbituminous rank.

In the Sibuguey district, Mindanao, there are three minable seams. These range from 30 centimeters to 2.5 meters. Both high carbon bituminous and semianthracitic and subbituminous coals are present in this district.

STRUCTURAL FEATURES OF PHILIPPINE COAL SEAMS

Perhaps the single factor that has contributed most to the nonexistence of well-developed coal mines in the Philippine Islands is the discontinuity of the beds. The peculiar physiographic conditions existing in the Philippine Islands at the time these coals were laid down, coupled with faulting and igneous intrusions, have resulted in the seams petering out sooner or later. Not one of the seams mined in any of the coal districts has remained unbroken or of uniform thickness or quality over any considerable area. In a few cases the gradually decreasing thicknesses along the outcrops have been shown to be due to the fact that the original bed was of restricted lateral dimensions. In other cases the seams have failed by simply pinching out. In a great many cases, however, faulting and folding have played a considerable part.

Igneous intrusions not only have cut through or bowed up the seams, but also have produced local metamorphism, which has changed the quality of the coal. On account of the peculiar depositional conditions and the subsequent folding and faulting the continuity of all the minable seams has been more or less uncertain. The continuity of these beds can only be determined by underground exploration work and diamond drilling, properly directed, after the surface geology has been thoroughly studied. A few of the structural features of Philippine coal seams are given in the diagrams shown as fig. 2. The most important thing that I wish to bring out is the fact that Philippine seams structurally will not permit mining on a large scale.

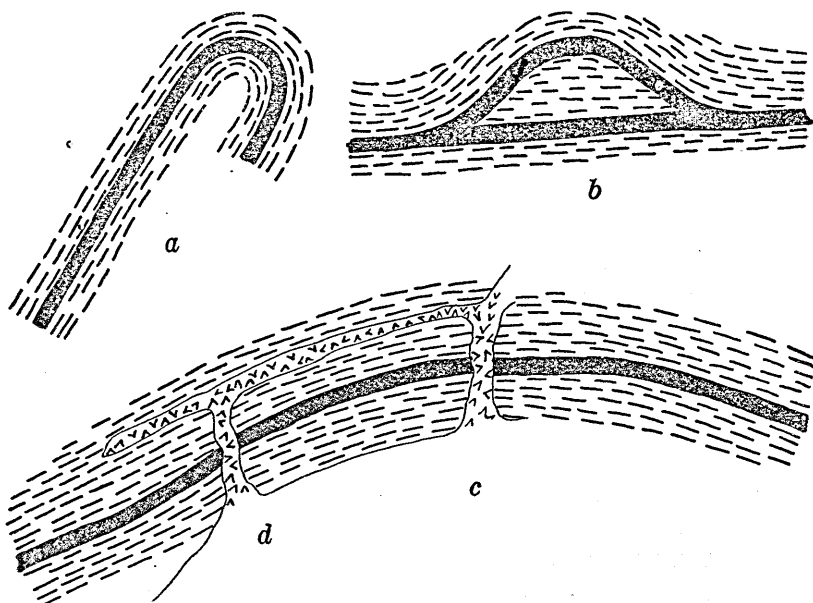


FIG. 2. Specific examples of irregularities of Philippine coal seams (diagrammatic): *a*, Abella seam, Mount Licos, Cebu, mine No. 8, National Coal Company, showing the fishhook character of the strike of the seam; *b*, Margarita seam, Mount Uling, Cebu, west tunnel No. 2, Uling-Naga Coal Company, showing bulging up of upper member probably due to lateral compression; *c*, principal seam at Butong, showing igneous-dike intrusions, *d*.

ESTIMATE OF COAL RESERVES

Any estimate of the coal reserves of the different coal districts of the Philippine Islands must be accepted with a great deal of caution. It is necessary to call attention to the fact that estimates made are based on measured distances on the surface and that underground development and drilling are not far

enough advanced to define the areas of proven coal. In Table 2 I have tried to be conservative and have given the various fields credit for all the coal which present knowledge warrants. These estimates must necessarily represent minimum tonnage, certainly much less than the amount actually present in the ground. The thickness of the coal used in the computation of the coal reserves is taken from the average measured sections of the coal seams now being mined. It is well to remember that the coal seams dip at all angles, up to 90° ; that they vary in thickness within a few meters, sometimes disappearing entirely; and that they are folded and faulted. In several of the districts two or three beds occur, but in the compilation of the tonnage shown in Table 2 only the principal seam has been considered. To make an accurate estimate of the tonnage of the Philippine coal districts it would be necessary to divide the districts into many sections, each section to be estimated on the basis of the coal known to occur under the area. But present workings are small, and the greater portion of the area supposed to contain coal has no workings at all. Some of the sections will have very little or no tonnage. It has been assumed that the resulting tonnage for any district by this method will be the same as if the estimate were made on the basis of one horizontal bed underlying the probable production area of the district. Fourteen hundred tons run-of-mine coal per vertical foot per acre has been used as a constant for all coal in estimating the tonnage.

METHODS OF MINING

The several methods of mining coal in the Philippines can be grouped under two classes; namely, the contract, or paquiao, method and a modified form of the room-and-pillar system. The contract, or paquiao, method is neither more nor less than outcrop mining. An operator with a small working capital and a handful of workmen starts mining on a coal outcrop. The coal outcrop has been located in an area, usually about 4 hectares, permission to work on the area having been previously secured from the Bureau of Lands under the terms of the so-called "revocable permit for coal prospecting." Mining is done by pick and shovel and the coal is taken out on improvised wheelbarrows and in baskets. Both men and small *balsas*, or sleds, drawn by carabaos or oxen are used to transport the coal from the mine to a main road or railway terminal. As most of the Philippine seams lie at a fairly high angle of inclination, these

operators do not go very deep underground, their drifts or slopes rarely exceeding 25 meters. The cost of timbering and haulage up the slope increases correspondingly with the length of the workings and sooner or later the water drives the workmen out. When conditions become such that the coal can no longer be taken out with profit the drifts or slopes are abandoned and work is started on another outcrop. This method of mining is exceedingly wasteful and dangerous. Coal Mountain in western Batan Island, Albay Province, is full of these "rabbit holes," as one operator appropriately calls them. They make the working of the coal beyond the outcrop difficult and costly, and sometimes impossible, on account of cavings and the water which usually accumulates in the abandoned workings.

These paquiao workings would have been of some value to the coal-mining industry had they been properly located and the results properly recorded; but in a great many cases the operators did not even know the thickness of their seams, let alone the dip and the materials composing the roof and the floor. On account of the absence of maps it is very difficult to locate any of the workings. A monthly report is required by Government regulations, but before the report (which in many cases does not give the desired information) reaches Manila, the operator has transferred to another place and has started another gopher hole.

The contract, or paquiao, method of work is responsible for a number of deaths in the coal-mining industry. In 1920 in Masaba Creek, barrio of Cantabaco, in the Mount Uling Coal District, Cebu, a number of people were killed by the falling of a portion of the overlying formation. Three coal seams outcrop on a bluff at the stream bed, and several paquiao operators were working on them. At one place the men had gone far into the interior without using much timber. One midday, while the crowd consisting of men, women, and children were eating luncheon at the drift entrance, the great portion of the bluff that had been weakened by the workings came down with a crash upon the unsuspecting crowd, burying a score of people alive. In May, 1925, in the Mount Uling coal district, a Japanese operator sank a small shaft near an abandoned slope working filled with water. At the bottom of the shaft he started an entry in the direction which he thought was opposite the slope. In driving his slope he had followed the coal and had driven a curved entry. The entry at the bottom of the shaft had not advanced more than 2 meters when the workmen struck the

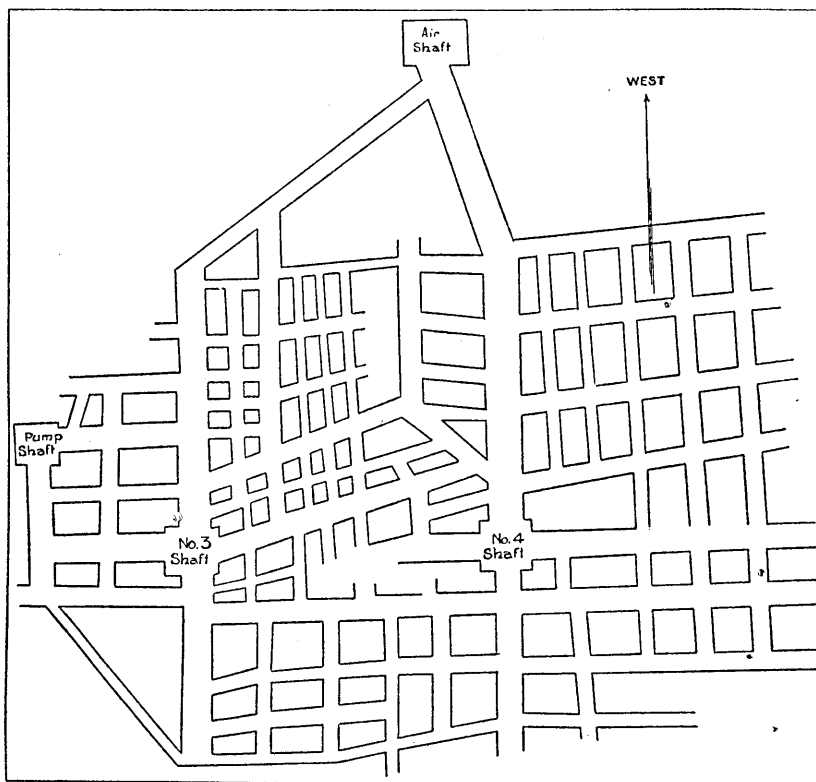


FIG. 3. Plan of underground workings of the Albay Gulf and Pacific Company's coal mine on Batan Island, Albay Province. Coal seam, 4 feet. July 1 to December 31, 1917, and January 1 to June 30, 1918. Scale 1 : 240.

lower end of the slope. The water that had accumulated in the slope broke through, filling the shaft almost to the top instantly. Two other workmen from the top of the shaft plunged into the onrushing waters in an heroic attempt to rescue their companions, but not one of them came up alive.

The better method of working Philippine coal mines is the room-and-pillar system. The single-entry system is used whereby the main entry is usually driven on the strike of the seam and rooms are driven up and down the dip. The main entry is the main haulageway, and oftentimes the air is conducted along it to the last room, then through all the working faces, and thence by a small air course to the upcast. On account of the generally poor roof the rooms are made not more than 3 meters wide. Close timbering is often required. Pick mining is the rule and

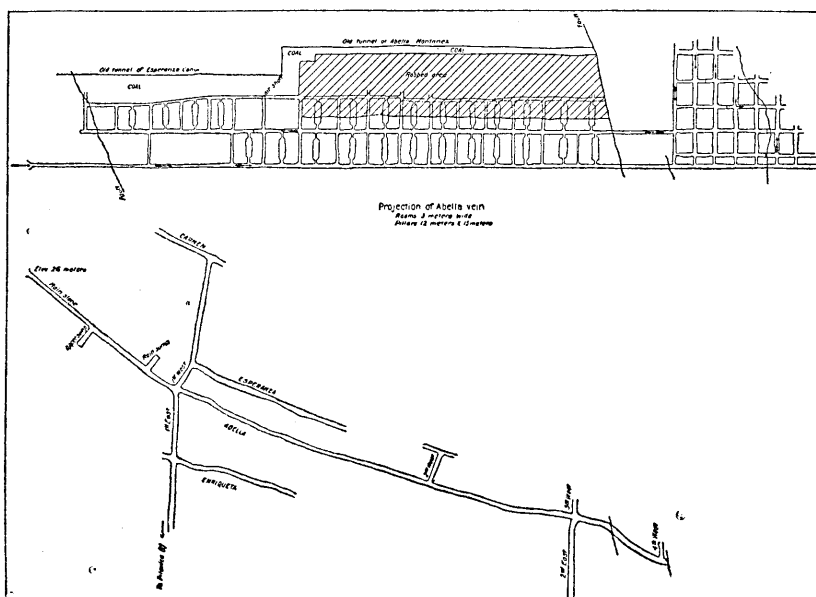


FIG. 4. Plan and section of mine No. 8, Mount Licos, Cebu. National Coal Co. September 31, 1924. Scale 1 : 1000.

the mined coal is sent down in chutes to be loaded on half-ton cars at the main entry. These mine cars are either pushed by men to the outside bunkers or, in case of slopes, are hauled up by means of wire rope.

The cost of mining a ton of coal varies between wide limits. Paquiao operators mine it much more cheaply than do the regular companies, as the mining of the former consists only in digging the coal outcrops. All the men employed are utilized in mining. There is no plant depreciation, no interest on capital invested, and no amortization as in the case of the companies. With the large mines the cost of maintaining haulage-ways is very high and the more extensive the workings the higher the maintenance. The deterioration of mine timbers is so rapid and the advance of the main entries so slow that, in case of long entries, while one set of workmen is timbering the advance another set is already engaged in retimbering some portions behind. Available data seem to point to the cost of mining a ton of coal in the Philippines as between 2 and 10 pesos. When to this cost are added the transportation charges to the market, it can readily be seen why the coal companies

have a very close margin of profit and sometimes none at all. In 1920 a few operators made money on account of the price of coal ranging from 50 to 60 pesos; but at present local coal is selling at only 11 to 18 pesos per ton.

ESTIMATED TONNAGE OF PROVEN COAL

On account of the peculiar mining conditions the total tonnage of proven coal is small. It is necessary to state here that by proven coal is meant coal blocked in three directions. With Philippine seams it is not safe to predict thickness and extension beyond the distance of the actual workings because, as pointed out elsewhere in this article, conditions of deposition and subsequent folding and faulting have been responsible for the petering out of some seams and the total absence of others. The development of most of the mines has not gone very far beyond the initial stage, and on not one of them has enough development work been done to insure an output beyond a year's work. If development work were stopped and all work directed toward mining the coal already blocked out, there would not be enough coal to mine for one year, and the amount produced would not exceed the average annual production during the last five years. In other words, the total tonnage of proven coal for the whole of the Philippine coal districts to-day will not exceed 50,000 tons.

PRODUCTION, IMPORTATION, AND CONSUMPTION OF COAL

TABLE 4.—*Production of coal in the Philippines from 1842 to 1924, inclusive.*

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	<i>Metric tons.</i>	<i>Pesos.</i>		<i>Metric tons.</i>	<i>Pesos.</i>
1842-1906.....	^a 30,000	450,000	1917.....	5,748	141,425
1907.....	4,123	26,800	1918.....	15,663	385,400
1908.....	10,035	77,166	1919.....	32,892	822,300
1909.....	30,336	197,184	1920.....	58,888	1,452,200
1910.....	28,655	176,255	1921.....	40,076	808,626
1911.....	^a 20,000	130,000	1922.....	42,420	856,345
1912.....	2,720	20,200	1923.....	43,446	874,441
1913.....	(b)	-----	1924.....	47,278	581,286
1914.....	(b)	-----	Total.....	412,280	-----
1915.....	(b)	-----			
1916.....	(b)	-----			

^a Estimated.

^b No commercial production.

HOW LONG WILL OUR COAL LAST?

In Tables 4 to 6 are presented in tabulated form, by years, the production, importation, and consumption of coal in the Philippine Islands from 1908 to 1924. In fig. 5 the relation between them is graphically presented. In Table 2 the esti-

TABLE 5.—*Importation of coal in the Philippines from 1908 to 1924, inclusive.*

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	<i>Metric tons.</i>	<i>Pesos.</i>		<i>Metric tons.</i>	<i>Pesos.</i>
1908 ^a	494,209	2,807,598	1917.....	403,507	3,076,470
1909 ^a	398,446	2,262,526	1918.....	405,110	4,662,349
1910 ^a	427,547	2,688,010	1919.....	400,537	7,781,307
1911 ^a	518,326	3,157,018	1920.....	540,055	10,792,077
1912 ^a	436,711	2,263,996	1921.....	461,889	6,987,004
1913.....	561,422	3,168,134	1922.....	461,478	5,009,362
1914.....	597,131	3,499,490	1923.....	465,286	4,997,302
1915.....	477,633	2,865,041	1924.....	479,698	4,581,515
1916.....	463,387	2,607,988			

^a Twelve months ending June 30.

TABLE 6.—*Coal consumption of the Philippine Islands from 1908 to 1924, inclusive.*

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	<i>Metric tons.</i>	<i>Pesos.</i>		<i>Metric tons.</i>	<i>Pesos.</i>
1908 ^a	504,244	2,884,764	1917.....	409,255	3,217,895
1909 ^a	428,782	2,459,710	1918.....	420,773	5,047,749
1910 ^a	456,202	2,864,265	1919.....	433,429	8,603,607
1911 ^a	538,326	3,287,018	1920.....	598,943	12,244,277
1912 ^a	439,431	2,284,196	1921.....	501,965	7,795,630
1913.....	561,422	3,168,134	1922.....	503,898	5,865,707
1914.....	597,131	3,499,490	1923.....	508,732	5,871,743
1915.....	477,633	2,865,041	1924.....	526,976	5,162,801
1916.....	463,387	2,607,988			

^a Twelve months ending June 30.

mated tonnage of Philippine coal reserves is placed at 21,200,000 tons. Of course, this represents the minimum quantity available and it is to be expected that a great deal more is present in our coal measures; but, under the present conditions of mining, these figures should be used in the consideration of the question of when our coal reserves will be exhausted.

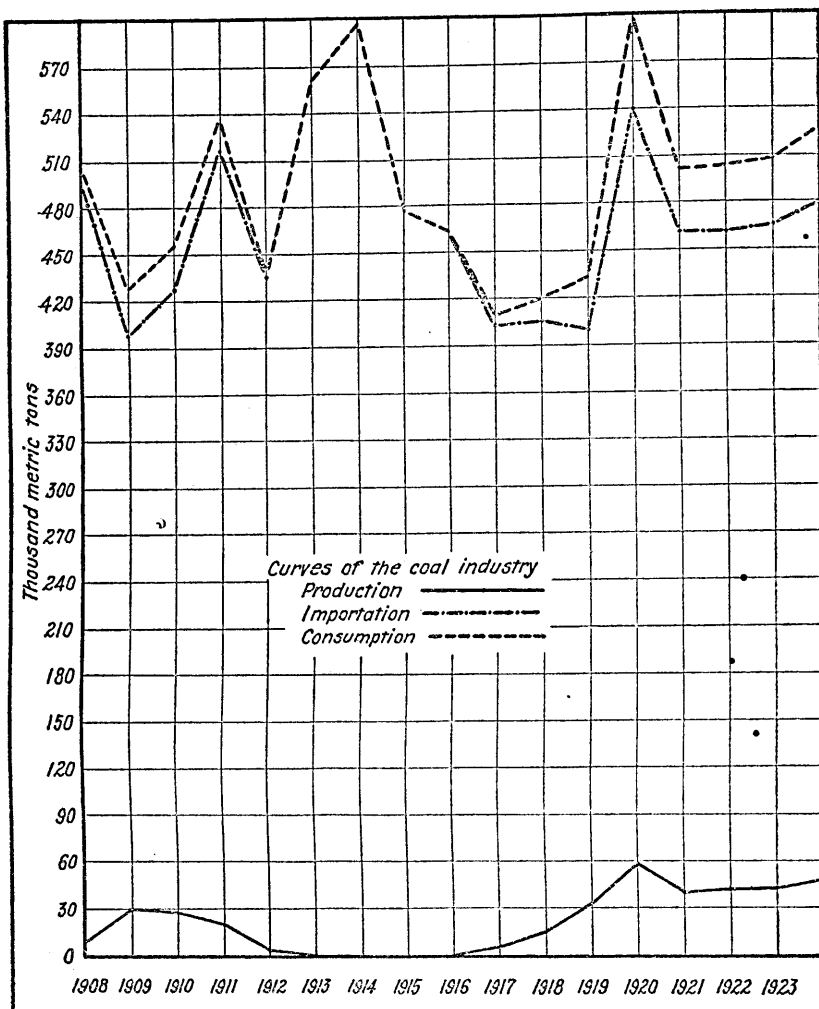


FIG. 5. Curves of the Philippine coal industry.

Philippine coal consumption averages about 500,000 tons yearly, although only about one-tenth of the total is produced locally. If all the coal needed by the Philippine Islands were produced at our own mines, our coal would be exhausted in forty-two years. However, the time when the Philippine Islands will be able to produce all the coal she needs is very remote. As a matter of fact, total production of coal for the Philippines since 1842, or a period of eighty-two years, is only 412,000 tons, or just a little more than the coal consumption

for 1917. During the last five years our average annual production has not exceeded 50,000 tons. At this rate total depletion of our own supply would be reached in four hundred twenty-five years. Assuming that we should be able to double the capacity of our mines and produce 100,000 tons annually, then total exhaustion would be reached in two hundred twelve years. From our present knowledge of the conditions in the coal districts a total production of 100,000 tons would not be reached during the next ten years, and probably not in twenty years. Structurally, none of the Philippine coal seams will admit mining on a large scale. An annual production of 100,000 tons should be the limit of our local production. It is important that we be brought to realize that our coal supply is not inexhaustible and that enough of it should be conserved to stabilize the industry. Our coal supply is small, and steps should be taken to prevent wastage, both in mining and in consumption. Loss in mining could be materially reduced by raising the standard of competency of all those engaged in the coal-mining industry, both by the employment of men who understand coal mining and by the use of methods applicable to our own peculiar conditions. A note of warning is sounded at this time because our losses in mining are enormous. The use of improper methods of working (namely, the gopher methods or the paquiao system) is here condemned, as such methods leave a great deal of coal underground which could be recovered and render difficult the working of that which is still minable. This condition is to be regretted, because some of the large companies are responsible jointly with the paquiao operators. Our coal supply is definite. We may not know how much we really have, but we do know that every ton mined, every ton left in the ground which can no longer be mined at some future date, and every ton not properly used reduces our available resources by just so much.

BIBLIOGRAPHY ON PHILIPPINE COAL

- ABELLA Y CASARIEGO, ENRIQUE. *Rápida descripción física, geológica y minera de la isla de Cebú*. Madrid, Tello (1886) 8°, 187 pp., 6 pls., 1 map; also *Bol. de la Com. del Mapa Geol. de España* 13 (1886).
- BECKER, GEORGE FERDINAND. *Report on the Geology of the Philippine Islands*. U. S. Geol. Survey 21st Ann. Rep. 3 (1901) 493-644, 2 maps, 1 pl.

- BUREAU OF LANDS. The Coal Land Act (No. 2719) and regulations governing the leasing and development of coal lands in the Philippine Islands promulgated August 15, 1917. Manila, Bureau of Printing (1918). (English and Spanish.)
- BUREAU OF SCIENCE. Pulverized coal and its advantages as fuel in the P. I. Press Bull. 89. (Issued December, 1918.)
- BURRITT, CHARLES H. The coal measures of the Philippines. Washington, Government Printing Office 2 (1901) 269 pp., 4 maps.
- CENTENO Y GARCÍA, JOSÉ. Carbón de piedra de Cebú. *Revista Minera* 18 (1867.)
- COX, ALVIN J. Philippine coals and their gas-producing power. *Philip. Journ. Sci.* 1 (1906) 877-902, 1 pl.
- COX, ALVIN J. The proximate analysis of Philippine coals. *Philip. Journ. Sci.* § A 2 (1907) 41-65.
- COX, ALVIN J. Classification of Cebu coal. *Philip. Journ. Sci.* § A 2 (1907) 400.
- COX, ALVIN J. On the analysis of lignite and sub-bituminous coals. *Journ. Am. Chem. Soc.* 29 (1907) 775.
- COX, ALVIN J. Summary of the chief characteristics of Philippine coals. *Min. Resources P. I. for 1907* (1908) 34-39; cf. *Eng. & Min. Journ.* 86 (1908) 1058 and 1059.
- COX, ALVIN J. The relationship between the external appearance and the ash content of Philippine coal. *Philip. Journ. Sci.* § A 3 (1908) 91-93.
- COX, ALVIN J. Philippine coals as fuel. *Philip. Journ. Sci.* § A 3 (1908) 301-356, 13 pls.
- COX, ALVIN J. Calorimetry, and the determination of the calorific value of Philippine and other coals from the results of proximate analysis. *Philip. Journ. Sci.* § A 4 (1909) 171-203.
- COX, ALVIN J. Chemical and physical characteristics of Philippine coal. *Philip. Journ. Sci.* § A 7 (1912) 1.
- COX, ALVIN J. The oxidation and deterioration of coal. *Philip. Journ. Sci.* § A 7 (1912) 297.
- DALBURG, FRANK A. The coal resources of the Philippines. *Min. Resources P. I. for 1911* (1912) 54-62.
- DALBURG, FRANK A. Coal mining in 1912. *Min. Resources P. I. for 1912* (1913) 38-40.
- DALBURG, FRANK A. The coal resources of the Philippine Islands. The coal resources of the world. An inquiry made upon the initiative of the Executive Com. of XII International Geological Congress, Canada (1913), 8°, Toronto 1 (1913) 107-123.
- DILWORTH, J. B. Philippine coal fields. *Trans. Am. Inst. Min. Eng.* 39 (1908) 653-664, 1 map; also *Bull. Am. Inst. Min. Eng.* 36 (1909) 39-50.
- DILWORTH, J. B. Coal mining in the Philippines. *Eng. Mag.* 37 (1909) 111-113.
- DILWORTH, J. B. Die Kohlenfelder der Philippinen. *Bergm. Rdsch. Kattowitz* 8 (1912) 249-254.
- FAUSTINO, LEOPOLDO A. Coal mining in the Philippines. *Min. Resources P. I. for 1917 and 1918* (1920) 28-37.
- FAUSTINO, LEOPOLDO A. Coal. *Min. Resources P. I. for 1921, 1922, and 1923* (1925) 31-40.

- FERGUSON, HENRY GARDINER. Coal in the Cagayan Valley. *Philip. Journ. Sci.* § A 3 (1908) 535-537, 1 map.
- FERGUSON, H. G., and R. N. CLARK. Coal in the Cagayan Valley. *Min. Resources P. I.* for 1909 (1910) 41 and 42.
- HAWXHURST, ROBERT. Mining coal in the Philippine Islands. *Eng. & Min. Journ.* 88 (1909) 879 and 880.
- HERNANDEZ, ANTONIO. Carbón de piedra de Filipinas. *Revista minera, Madrid* 5 (1854).
- HERNANDEZ, ANTONIO. Carbón mineral de la isla de Cebú. *Revista minera, Madrid* 5 (1854).
- LAVA, V. G. The possible use of Philippine coals for liquid fuel. *Philip. Journ. Sci.* 28 (1925) 193-204.
- LEDNICKY, VICTOR E. Coal mining possibilities in the Philippine Islands. *Min. Resources P. I.* for 1916 (1917) 17 and 18.
- MECHAIN. Combustible mineral de la Isla de Cebú. *Ann. des Mines* (1865).
- PRATT, WALLACE E. On briquetting Philippine coals. *Min. Resources P. I.* for 1910 (1911) 79 and 80.
- PRATT, WALLACE E. Coal mining in 1913. *Min. Resources P. I.* for 1913 (1914) 32 and 33.
- PRATT, WALLACE E. The persistence of Philippine coal beds. *Philip. Journ. Sci.* § A 10 (1915) 289-302.
- PRATT, WALLACE E. Coal in the Philippines. *Coal Age* 9 (1916) 491-497.
- REINHOLT, O. H. Coal mining in the Philippines. *Eng. Mag.* 30 (1906) 491-517.
- REINHOLT, O. H. United States enterprise in the coal trade of the Philippines. *Eng. Mag.* 30 (1906) 510.
- RICE, G. D. Coal fields of the Philippines: Facts in regard to their location, extent, quality of the coal and the opportunity for profitable operation. *Mines and Minerals* 21: 205.
- SMITH, WARREN DUPRE. The coal deposits of Batan Island. *Min. Bur. Bull., Manila* 5 (1906) 56 pp., 11 photographs, 11 maps and sections; *abs. Far Eastern Review* 2 (1906) 301, 304-310.
- SMITH, WARREN DUPRE. The geology of the Compostela-Lanao coal field. *Philip. Journ. Sci.* § A 2 (1907) 377-403, 14 pls., 3 maps; *Rev. Geol. Mag.* 5^o (1908) 279; partial reprint in *Mining World* 28 (1908) 333; *rev. Journ. Geol.* 16 (1908) 586; *ex Far Eastern Review* 4 (1908) 298-302; 4, 14.
- SMITH, WARREN DUPRE. The coal resources of the Philippine Islands. *Econom. Geol.* 4 (1909) 224-238, 1 map.
- SMITH, WARREN DUPRE. Philippine coal; subheads "Coal in Albay Province" and "Coal in Cebu." *Min. Resources P. I.* for 1909 (1910) 36-40; *ex Far Eastern Review* 7 (1910) 121-124, includes Albay, Cebu, and Cagayan Valley.
- SMITH, WARREN DUPRE. The coal resources of the Philippine Islands. *Min. Resources P. I.* for 1910 (1911) 37-56.
- SMITH, WARREN DUPRE. Coal deposits and mines of the Philippine Islands. *Trans-Pacific* (Oct.-Nov., 1921).
- SMITH, WARREN DUPRE. Geology and Mineral Resources of the Philippine Islands. *Bureau of Science Pub.* 19 (1924) 363-384.

- SMITH, WARREN DUPRE. Coal in the Philippines. *The Far Eastern Review* (1925) 558-563. [Reprint from *Geology and Mineral Resources*, Bureau of Science Pub. 19 (1924).]
- WIGMORE, H. L. Report of the investigation of coal deposits on the Batan Military Reservation, Batan Island, P. I. Washington, Government Printing Office (April, 1903).
- WIGMORE, H. L. Philippine coal deposits. *Mines and Minerals* 26 (1906) 529-536.
- WRIGHT, LUKE E. (By order of). Successful test of Polillo (Philippine Islands) coal and reports of experts on the same. *Far Eastern Review* 2 (1906) 223-224.
- YCASIANO, F. R. Philippine coals and their use. *Min. Resources P. I.* for 1915 (1916) 32-36.
- YCASIANO, F. R. A recalculation of certain data on steaming tests of Philippine coals. *Philip. Journ. Sci.* § A 13 (1918) 341-346.

ILLUSTRATIONS

PLATE 1. Map of the Philippine Islands, showing location of coal districts.

TEXT FIGURES

- FIG. 1. Sections from different coal mines: *a*, 11 meters from section 2, tunnel No. 7, Liguan coal mines, Batan Island; *b*, face of tunnel No. 1, Betts's mines, Batan Island, September 19, 1924; *c*, average section of big seam, west tunnel No. 3, Uling-Naga Coal Co., Mount Uling coal district, Cebu, May, 1925; *d*, face of side entry No. 6, water-level tunnel, Gotas, Sibuguey, Mindanao, January 21, 1925.
2. Specific examples of irregularities of Philippine coal seams (diagrammatic): *a*, Abella seam, Mount Licos, Cebu, mine No. 8, National Coal Company, showing the fishhook character of the strike of the seam; *b*, Margarita seam, Mount Uling, Cebu, west tunnel No. 2, Uling-Naga Coal Company, showing bulging up of upper member probably due to lateral compression; *c*, principal seam at Butong, showing igneous-dike intrusions, *d*.
 3. Plan of underground workings of the Albay Gulf and Pacific Company's coal mine on Batan Island, Albay Province. Coal seam, 4 feet. July 1 to December 31, 1917, and January 1 to June 30, 1918. Scale, 1: 240.
 4. Plan and section of mine No. 8, Mount Licos, Cebu. National Coal Co. September 31, 1924. Scale, 1: 1000.
 5. Chart showing curves of the Philippine coal industry.

1926

Coal districts

ANCYLOSTOMIASIS: RELATION BETWEEN NUMBER OF OVA PER GRAM OF FORMED STOOL AND NUMBER OF FEMALE WORMS HARBORED BY THE HOST, I

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For the past few years the Department of Medical Zoölogy, School of Hygiene and Public Health, Johns Hopkins University, with the coöperation of the International Health Board, Rockefeller Foundation, has been carrying on intensive investigations on the control of hookworm disease. Cort(1, 4, 7) and his associates, particularly Stoll,(2, 3, 9) (the latter devised the egg-counting method(3)) have shown in Porto Rico(5, 6) the applicability of the egg-counting method (on "random" specimens per gram "formed basis") in hookworm-control work in the field and, from an economical and technical point of view, they consider it distinctly superior to other procedures heretofore used.

For the purpose of testing the applicability of this procedure (so that it might be adapted to other parts of the Philippines having a population similar to that of this locality) I subjected patients of a Philippine Health Service hospital to egg counts before and after (four to five days) anthelmintic treatment. I saved and classified all worms recovered for forty-eight hours, to determine whether or not any definite or approximate correlation could be shown to exist between the number of ova per gram of formed fæces and the number of female worms discharged or harbored by the host.

The patients were all Filipinos (except one, a Chinese), adults, representing both sexes; they were walking patients who had fully recovered from their admission ailments and were on full diet and, I believe, could very well be compared with field cases. Their diet was uniform in quality (large quantities of rice and vegetables and a lesser ration of fish and meat) but varied in quantity. The laboratory technic was essentially the same as that used by Stoll, although slightly modified on account of lack of large slides, cover glasses, 50-cubic-centimeter

test tubes, and a mechanical stage. The collection of stools was under the direct supervision of an experienced graduate nurse and a well-trained senior student of the training school. The patients were well instructed, particularly in the collection of the forty-eight-hour stools. Each bed pan had a large, black, 2-inch number painted on cover and body, besides the paper label, so that, should the chambers be kept in the toilet room, no mistake could occur. Usually, however, the chambers were at the bedside. The numbers were intended especially for those who could not read. The stools were screened through a sieve (80 meshes to the square inch) at the end of each twenty-four-hour period.

The personnel engaged in this work consisted of a well-trained nurse technician and a screener. The egg counts were made, either by the technician or by me. The screening was also directly supervised and watched. All worm classifications were made the same day by me. Before observations were made on the series reported, we practiced on about 150 stool counts on bed patients.

TECHNIC

The stools were all "random" specimens and were received in enamel sputum cups labeled with name, etc. The character (diarrhoeic, mushy, or formed) was noted at once on the label. White, wide-mouthed bottles (137-cubic-centimeter capacity to the neck and marked to the 45-cubic-centimeter level) were used, owing to lack of 50-cubic-centimeter test tubes. A bottle was put in one pan of a pharmacists' balance (sensitive to 0.1 gram), a 3-gram weight was placed opposite the bottle, and exactly enough stool was put into the bottle by the aid of a cocoleaf midrib to balance the 3-gram weight on the opposite pan. If the stool was diarrhoeic it was first thoroughly stirred. Then enough 0.1 *N* sodium hydrate was carefully poured into the bottle to the 45-cubic-centimeter mark, about a dozen glass beads were added, the bottle was stoppered with a tightly fitting rubber cork, and the mixture vigorously shaken for at least one minute, or until it was very thoroughly emulsified. The pipette used was graduated to 0.1 and 0.01 cubic centimeter to the tip. Ordinary laboratory slides were used, without cover glass and without a mechanical stage. Where the ova were very few, those on three or four slides of 0.1 cubic centimeter each were counted; otherwise, those on two slides were counted and recorded on the back of the original label of the specimen. The computa-

tion was made by multiplying the average number of ova per slide of 0.1 cubic centimeter by 150, to obtain the number of ova per gram.

Using bottles made unnecessary the use of racks for holding them, and they probably received more-vigorous shaking. By closing the top end of the pipette with the tip of the index finger and tilting the bottle slightly, it was easy to get about 0.25 cubic centimeter of the shaken content and, after releasing the extra material to the 0.2-cubic-centimeter mark from the tip, touching the inner wall of the mouth of the bottle, 0.1 cubic centimeter was slowly transferred on the slide by rotating the pipette with the thumb and middle finger and, at the same time, the material was spread over an area of about 7 square centimeters. The remaining 0.1 cubic centimeter was not used. We covered this area by manual manipulation of the slide in about one hundred fields under a $\frac{2}{3}$ objective, eyepiece No. 4. This was probably our greatest source of error tending to diminish the count, as it was probably easier to move the slide too much to miss some fields than to go over the same field twice. Had we used 0.15 cubic centimeter, the quantity used by Stoll, the entire ordinary slide would have been covered reasonably thinly, and thus handling would have been prevented; so 0.1 cubic centimeter was used. Plane slides were used and the microscope stage was well leveled. These precautions were taken to avoid the flowing of material to one side or the other of the slide. By taking only about 0.25 cubic centimeter in the pipette error in the settling of ova, which might occur if a higher column of material were used (particularly if the ova were numerous), was probably averted.

The treatment stools were dumped into the screen and the chamber was rinsed into it. The paper was washed piece by piece under running water into the screen. All particles of formed stools were crushed in gloved hands and the material was thoroughly washed until only vegetable particles remained. The gloved-hand manipulation was necessary as stools in this locality contain large quantities of debris and firm or pasty lumps. The worms were picked up with a pointed coco-leaf midrib and transferred into a Petri dish with tap water. No stool was discarded as free from worms until after at least four or five washings, when the last one or two washings failed to reveal an adult worm. The classification was done by the naked eye; all doubtful specimens and broken males were examined under the microscope.

The medicament given was oil of chenopodium. The patient was given soft-boiled rice for supper. At 6 a. m. 1.5 cubic centimeters of the oil, freshly filled into gelatine capsules, were given and the dose was repeated at 8 a. m. At 10 a. m. a dose of 45 cubic centimeters of saturated watery solution of magnesium sulphate was administered.

Stool collection began from the time the oil was given, and continued until 6 a. m. the next day. Sometimes there was no bowel movement the following twenty-four hours, and in such case the third twenty-four-hour stools were saved.

In the interpretation of results all egg counts on diarrhœic or mushy stools were multiplied by 4 and 2, respectively. The factor 44 ova per gram of stool "formed basis" per female worm was used. All pretreatment and posttreatment egg counts were on "random" stools.

INTERPRETATION AND DISCUSSION OF DATA

Considering the series collectively it will be seen that the eighteen patients showed a total egg count of 15,710 per gram "formed basis," or 873 ova per case before treatment (see Table 1). The treatment removed 363 females, or an average of 20 per patient. The posttreatment count showed 4,275 ova, or 237 ova per patient, a diminution of 73 per cent.

The total theoretical number of females was about 357, or about 20 per patient. It is very apparent therefore that the correlation was almost perfect, as the actual total number of females recovered (363) did show a pretreatment egg count on eighteen stools reduced to "formed basis" of 15,710 ova, or 43.3 per female recovered.

A perusal of the table showed, however, that four patients (4, 7, 9, and 13) only contributed to the ova found after the first treatment and the number of ova from patients 4, 7, and 9 (1,275) did not correlate with the number of females recovered (two) by the second treatment. These four cases contributed 22 per cent of the series.

Taking the remaining fourteen patients as a whole, we find that 10,760 ova, or 769 per patient, constituted the total pretreatment count. There were 287 female worms removed by treatment, or 20 per patient. Each female worm was therefore represented by 38 ova per gram. The theoretical number of females, based on the pretreatment count, is 245, or about 17 per patient. The posttreatment count was 0, or 100 per cent cure. This is visible evidence of the inferiority of the egg-count-

TABLE 1.—Showing all the data collected from the series of eighteen hookworm patients.

Serial No. of pa- tient.	Name.	First examination.			Worms recovered by first treatment.				Theor- etical number of fe- males at 44 ova per gram.	Reëxamination.			Worms recovered by second treatment.				Third examination	
		Type of stool.	Number of ova per gram.	Number of ova reduced to formed basis.	Ancylostoma.		Necator.			Type of stool.	Number of ova per gram.	Number of ova reduced to formed basis.	Ancylostoma.		Necator.		Type of stool.	Number of ova per gram.
					Male.	Fe- male.	Male.	Fe- male.					Male.	Fe- male.				
1	V. J.	Mushy----	130	260	0	2	0	0	6	Formed----	0	0						
2	H. R.	do-----	225	450	0	0	2	4	10	Mushy----	0	0						
3	G. L.	do-----	450	900	2	2	16	6	20	do-----	0	0						
4	E. A.	Diarrhœal.	75	300	1	0	10	4	7	Formed----	675	675	0	0	1	0	Formed.	0
5	C. M.	Formed----	150	150	0	0	7	3	3	do-----	0	0						
6	M. S.	do-----	300	300	1	0	4	4	7	do-----	0	0						
7	E. Y.	Diarrhœal.	300	1,200	7	7	82	53	27	Diarrhœal.	75	300	0	1	0	0	Formed.	0
8	S. E.	Mushy----	225	450	1	0	2	4	10	Formed----	0	0						
9	D. F.	do-----	1,275	2,550	0	1	0	3	58	Mushy----	150	300	0	1	0	0	Mushy--	0
10	F. S.	Diarrhœal.	150	600	1	4	12	37	14	Formed----	0	0						
11	M. F.	Formed----	1,425	1,425	3	0	11	21	32	do-----	0	0						
12	F. F.	do-----	150	150	1	3	0	0	3	Mushy----	0	0						
13	G. L.	Mushy----	450	900	2	2	16	6	20	do-----	1,500	3,000						
14	E. E.	Formed----	4,800	4,800	0	0	119	180	109	Formed----	0	0						
15	D. R.	Diarrhœal.	150	600	0	0	12	14	14	do-----	0	0						
16	L. R.	do-----	75	300	0	0	1	2	7	do-----	0	0						
17	D. O.	do-----	75	300	0	0	1	2	7	do-----	0	0						
18	A. A.	Formed----	75	75	0	0	3	1	2	Diarrhœal.	0	0						
Total.				15,710		21		342	356			4,275		2		0		

ing method in microscopic diagnosis; my experience showed that only 40 per cent were cured by one chenopodium treatment controlled by a concentration method.

For the purpose of determining the number of variants for high or low egg count and the degree of variation in each individual case or group of similar cases, and how they neutralized to give such perfect correlation in the series when taken as a whole, an analysis of the cases was made, as the possibility did not seem to be excluded that this remarkable correlation was accidental.

Patients 5, 12, and 15 correlated exactly—that is, if all worms were discharged and recovered, a premise which seemed rather impossible.

Patients 1, 2, 3, 6, 8, 11, 16, 17, and 18 showed apparent good correlation, as previous experience with chenopodium showed that about 10 per cent of the worms (males and females) were left after one treatment, when a certain percentage of loss was allowed.

Patients 10 and 14 showed a low count for the actual number of females found.

Patients 4, 7, and 13 showed negative valid correlation. The rise of the egg count in patient 4 after treatment may be due to error in reducing diarrhœal to “formed basis” counts; but the nonrecovery of even a female in the second treatment did not seem to justify the count of 675 ova per gram.

In patient 7 the discrepancy between the actual (60 females) and the theoretical (27 females) may also be explained by the reduction of diarrhœal to “formed basis;” but in the second treatment the reduction of diarrhœal to “formed basis” worked just the opposite, the theoretical number being about 7 while the actual was only 1. Of course, some females might have been lost or retained by the patient.

Patient 13 was unfortunately not given a second treatment, but the control count was significantly high after the first treatment.

Patient 9 showed a pretreatment count of 2,550 ova per gram, which theoretically represented 58 females. Treatment removed 4 females and the control count showed 300 ova per gram, or a reduction of 88 per cent in ova, or 88 per cent of egg-laying females.

Four females removed represented 7 per cent of the theoretical 58. This is contradictory to the experience with chenopo-

dium which removed about 90 per cent by the first treatment; but, supposing this low recovery of worms (females) was due to loss in screening and the recovery be placed at 15 per cent, this would mean that 50 females, or about 85 per cent, were still left.

The control count, as stated above, was 300 per gram or, theoretically, 7 females. The second treatment removed 1 female and reexamination showed no ova. Granting that in the second treatment some females were again lost and some retained, a correlation could be made with the 300 egg count; but the discrepancy between the theoretical 50 females left after the first treatment and the theoretical 7 females, based on the count after the first treatment, is so apparent that some other explanation seems needed.

It will be seen that patients 1, 2, 3, 6, 8, 11, 16, 17, and 18 appeared to show reasonable correlation; but, when, the figures are put together, they will show the following:

Total ova per gram for the nine patients	4,460
Female worms recovered by first treatment	46
Average ova per gram per case	495
Average female worms per case	5
Average ova per gram per female worm	100

This is a high count, even if a certain percentage be allowed for retention and loss after treatment.

The abnormal cases (4, 7, 9, and 13) showed a total number of 4,950 ova per gram, or 1,237 per case. The actual number of female worms was 76, or 19 per case. In this group one female was represented by 65 ova per gram in the pretreatment stool.

It is significant that patients 4, 7, and 9 were given two treatments, with a count of 1,275 ova after the first treatment for the three patients representing about 30 female worms still left; but the second treatment, which cured, gave only 2 females for the three patients. Of course, some were lost.

Patients 5, 10, 12, 14, and 15 were all low variants, as the total ova per gram before treatment was 6,300, or 1,260 per patient. These five patients discharged 241 female worms, or 48 worms per patient. Each female therefore was represented by 26 ova per gram in the pretreatment stool. Posttreatment examination (four to five days later) was negative as to egg count. The actual number may even have been lower than 26 ova per female, as some females were either retained or lost in screening.

From the above discussion it will be seen that thirteen high-count variants with low female worm counts were neutralized by five low-count variants with a high number of females recovered. Nine of the series, or 50 per cent, were high-count variants; four, or 22 per cent, moderately high-count variants; and five, or 28 per cent, low-count variants.

Were this neutralization always to occur in field work, the egg-counting method would be very advantageous; but, since neutralization is governed by the number of unknown variants and the unknown degree of variations in egg counts and female worm population of the hosts, the result of the work would be uncertain and figures would have to depend on luck.

The perfect correlation observed is probably accidental. Sweet, (8) working in Australia, noted a higher theoretical number of female worms than were actually recovered by treatment, and he thought that this might be due to higher egg output of *Ancylostoma duodenale*.

My views in explanation of the observed variabilities are as follows:

Volumetric.—Given a constant number of ova, the number per gram of "formed basis" should be inversely proportional to the volume of stool.

Biological.—The existence of one good or poor egg-laying "race" or "strain" of hookworm or different species, or both in the same host, or the existence of many young or old non-egg-laying females will cause variability.

Immunological.—The inability of *Ancylostoma caninum*, for example, to infect man the way the other species do, is evidence of resistance of the host or susceptibility of the parasite (*A. caninum*). It may be possible that even with *Necator* some hosts are more resistant than others and are capable of minimizing the egg production of the females living under such opposition. The reverse may also happen, and the resistance of the host may also vary.

Mechanical.—The ova may adhere to the mucosa after protrusion and particularly behind rugæ and thus escape mechanical transportation by the intestinal contents. There may be stasis in some parts of the gut, particularly the cæcum, and this stasis may accumulate ova and the faecal matter be moved at irregular intervals. Lastly, partial or complete intestinal obstruction may impede the passage of ova-containing stool. The condition, however, that seems most likely to occur in the apparently healthy is the occurrence of transitory spastic functional con-

striction rings, something like those which occasionally cause intestinal obstruction without external or internal evidence of cause outside or inside the gut, which happens in Hirschsprung's disease or syndrome.

Chemical.—Probably a certain reaction of the contents of the small intestine is required for the best existence of the worm. Should this reaction change, some effect may be felt by the egg-producing females. The decomposition of intestinal contents due to bacterial proliferation, or the liberation of split protein products, or starch fermentation may influence egg production and protrusion. In normal hosts the character of the foodstuff and ingestion of drugs and alcohol may influence the oviposition. Lastly, ovolysis may occur in some pathologic cases.

From the above briefs, it seems evident that the analogy found by Stoll(9) in egg output, as measured by the egg-counting method, between the egg harvests of a chicken coop with 100 hens and one with 10 and one human host with 100 female hookworms and another with 10, should be subjected to serious consideration before being accepted. In the first place, the coop cannot, and should not be compared with the human host. The generalized 10-to-1 ratio of the number of eggs gathered from the two chicken coops would occur only were the hens all 200-eggs-per-year white Leghorns, reared or bred in the same way, fed the same food, housed in equally proportioned sanitary coops, and observed in the same locality and under the same climatological conditions. It must also be taken for granted that the egg gatherers in both cases were equally efficient and, lastly, that eggs were not lost either from the coop or by robbery, or by destruction by the hens themselves or by other animals. The above conditions could easily be controlled so that uniform results in chickens could be obtained; but it is doubted if such control, outside of reducing human-stool egg counts in "formed basis," could very well be applied in *ancylostomiasis*.

Some studies are being undertaken in the hope of confirming or disproving the validity of at least a few of the points advanced as possible causes of the noted variability of egg counts. Technical errors in methods, counts, etc., have not been considered, but the greatest care was exercised to minimize them.

SUMMARY

1. Eighteen hospital patients, all adult Filipinos (except one Chinese), representing both sexes, walking patients, fully recovered from their admission ailments and under the same diet,

were subjected to hookworm-egg counts and treated with oil of chenopodium (3 cubic centimeters with a saline purge). The treatment stools passed during forty-eight hours were searched for expelled adult worms and control stools were reexamined four to five days later by the same method (egg count). Three patients were treated a second time and similarly controlled. These cases, I believe, could very well be compared with field cases.

2. The stool counts were all on "random" specimens and all counts were reduced to "formed basis" in the interpretation of results, using the factors 1, 2, 4 of Stoll for formed, mushy, and diarrhoeal stools, respectively. The factor 44 ova per gram per female worm was also used; the technic was similar to Stoll's, though slightly modified owing to lack of some equipment.

3. Extreme care was taken in the collection and search for adult worms, in treatment stools. It must however be assumed that a small percentage was unavoidably lost.

4. Taken as a whole, the series showed perfect correlation between the number of ova per gram of stool "formed basis" of "random" specimens and the number of females expelled, 44 ova per gram per female.

5. By analysis of cases individually, high- and low-count variants were classified and grouped.

6. Nine cases, or 50 per cent of the series, which on first sight showed apparently reasonable correlation, on analysis were found to be variants (100 ova per female).

7. Four anomalous cases, or 22 per cent of the series, were also moderately high variants (65 ova per female).

8. Five cases, or 28 per cent of the series, were low variants (26 ova per female).

9. The series was made up entirely of either high or low variants, thirteen cases of the former and five cases of the latter.

10. The perfect correlation obtained is believed to be accidental rather than usual.

11. The accuracy of results obtainable in field work, where the egg-counting method is to be applied for the first time, will therefore have to depend on pure luck, as under such conditions the neutralization of high variants by low variants cannot be anticipated, unless determined first by a test series such as the one reported.

12. Judging by the results here discussed, it may be safe to use the egg-counting method in this locality (Zamboanga).

13. The view is advanced that volumetric, biological, immunological, mechanical, and chemical factors have influenced the variability noted in the per-gram egg counts on "random" specimens in this series when considered individually and in groups. The cases studied were few, but the views advanced seem justified.

14. That the number of ova per gram of stool "formed basis" is directly proportional to the number of females harbored by the host cannot be denied; but the correlation in the test cases, though almost exact when taken as a whole, showed variants in all, and variable degrees of fluctuation in both egg and female-worm counts; these factors govern neutralization, and a test series should be observed before the method is applied in any given locality. Where localities and population are similar this need not be done.

ACKNOWLEDGMENT

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REFERENCES

1. CORT. *Am. Journ. Hyg.* 4 (1924) 213-221.
2. STOLL. *Am. Journ. Hyg.* 3 (March, 1923).
3. STOLL. *Am. Journ. Hyg.* 3 (1923) 59-70.
4. CORT. In Cort, Hegner, and Root, *Outlines of Medical Zoology*. Mc-Millan Co. (1923) 87-89.
5. PAYNE, CORT, and RILEY. *Am. Journ. Hyg.* 3 (May, 1923).
6. HILL. *Am. Journ. Hyg.* 3 (July, 1923).
7. CORT. *Am. Journ. Hyg.* 5 (January, 1925) 49-89.
8. SWEET. *Am. Journ. Hyg.* 4 (November, 1924) 691-698.
9. STOLL. *Am. Journ. Hyg.* 4 (September, 1924) 466-500.

ANCYLOSTOMIASIS: RELATION BETWEEN NUMBER OF OVA PER GRAM OF FORMED STOOL AND NUMBER OF FEMALE WORMS HARBORED BY THE HOST, II

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For the purpose of determining some of the causes of the discrepancies noted between the number of hookworm ova per gram of formed stool and the number of female worms discharged by the host, in a series of chenopodium-treated patients controlled by the egg-counting method, I made a series of observations on eighteen fresh cadavers (none later than twenty-four hours after death) sent to me for autopsy. This paper deals with the egg counts in stools from the sigmoid or rectum in five cases and regional egg counts from the ileum, cæcum, transverse colon, and sigmoid in thirteen cases, with corresponding worm counts and classifications.

TECHNIC

After exposing the abdominal cavity and before any manipulation of the viscera was done, the ileum was severed with scissors at its junction with the cæcum, the cut end pinched, the mesentery cut, freeing about 0.5 meter of the gut, and then the contents were gently squeezed with the fingers into a marked Petri dish. A small hole was punched in the cæcum and without manipulation its contents were pressed through the hole directly into another Petri dish. The same procedure was followed with the transverse colon. When there was no palpable stool in the rectum, this was cut, freed from its attachment, and the faecal matter in the sigmoid expressed into a fourth Petri dish. Then the gut was removed, beginning either from the rectum or from the duodenum (care having been taken that no intestinal content should escape from either end or from the punctures in the cæcum and transverse colon) directly into a large deep sieve, 80 meshes to the square inch. The gut was opened and washed with running water directly into the sieve, and formed stools were macerated with gloved hands. During

the washing the fingers were passed several times over the mucosa and this at the same time was inspected inch by inch, as attached hookworms were often found hidden behind intestinal rugæ; this was particularly true in case of recent death. When the postmortem was made in the morning the egg counting and classification were done the same day. When the autopsy was made in the afternoon or evening the counting was sometimes postponed until the following morning. Under such circumstances, the screen with the washed intestinal contents was put in the sink and the water allowed to drip from the faucet all night to keep it moist. Extreme care was taken in inspecting the autopsy table and body cavity for worms if spilling of intestinal contents accidentally happened. The screen was always washed many times before it was discarded, as the overturning of food débris often revealed a hidden worm. Sometimes as long as five hours' search was made on bulky stools. In spite of these precautions it must be assumed that worm counts were usually short a very few that were lost or overlooked.

The technic of egg count and classification was the same as that described in the preceding article.¹ The cases submitted for this study were five for rectal or sigmoidal counts and thirteen for regional counts; namely, one American, one Chinese two Mohammedan Filipinos, and fourteen Christian Filipinos. Twelve were males and six females; two were infants, 12 and 13 months old, and the rest were adults from 17 to 52 years of age. Among those subjected to regional counts were one healthy adult Filipino laborer, who committed suicide by stabbing himself in the chest and died in fourteen hours; a well-developed and well-nourished Filipino multipara who died a few hours after the beginning of labor; one case who died of cerebral hæmorrhage; and, lastly, a case of murder. These cases might very well be considered representative normal cases because of absence of pathological lesions. Four other cases without lesions in the gastrointestinal tract can be considered fair controls.

No attempt will be made to express percentages of male and female parasites or the *Ancylostoma* formula, as those points can be better dealt with in a larger series. It is evident, however, that the *Necator* predominate over the *Ancylostoma* and the female worms over the male.

¹ Antea p. 36.

ANALYSIS OF DATA

For the purpose of analysis I used Stoll's factors 1, 2, 4 for formed, mushy, and diarrhoeal stools, respectively. The factor 44 ova per gram of formed faeces per female was also used, and it was also taken for granted that the stools removed at postmortem represented "random" samples. It was also assumed that in normal alimentary physiology the stool lost fluid by dehydration in its course to the rectum.

For pathological and biological reasons the eighteen cases were divided into three groups, as follows:

Group 1.—Normal controls, four cases (7, 11, 17, and 18), death sudden, or due to violence, in apparently healthy persons.

Group 2.—Death due to disease of an organ or organs not directly related to the alimentary tract, four cases (5, 6, 8, and 14).

Group 3.—Cases with intestinal pathology, ten cases (1, 2, 3, 4, 9, 10, 12, 13, 15, and 16).

GROUP 1

Case 7 showed perfect correlation in the transverse colon stool, slightly high count in the sigmoid, and higher in the ileum and caecum, or 74,183 and 105 ova per gram, respectively, per female found; high counts, therefore, in 75 per cent of the regions examined.

In case 11 correlation was evident in three regions (ileum, transverse colon, and sigmoid) but not in the caecum with 114 ova per gram per female; also a rather high count in 25 per cent of the regions.

Case 17 showed correlation in three regions (ileum, caecum, and transverse colon) but not in the sigmoid with 120 ova per gram per female found; high count in 25 per cent of the regions.

In case 18, assuming that one or two worms were lost in screening, correlation would be evident though the sigmoid count was slightly high; high count in 25 per cent of the regions.

Viewing the data from the standpoint of the theoretical number of females based on the regional egg counts, if case 7 had not committed suicide and if an egg count had been performed after he had passed his sigmoidal stool, he would be said to have had about 140 females; when he had passed the transversal stool, he would be said to have had at least 83 females; in the caecal stool, more than 200 females; and in the ileal stool, over 354 females (the intestinal content losing more and more fluid

in its course to the rectum), while the actual number of females was only 83.

If this case were presented or were examined in a survey there would be three chances out of four of missing the actual number of females he harbored.

Cases 11, 17, and 18 would each give a field investigator only one chance out of four of missing the actual number of females. The last two cases were very light infections.

Of the regions surveyed in these four control cases six, or about 38 per cent, showed high egg counts. This is significant, as it is what may happen in field work.

GROUP 2

Case 5 (sigmoidal stool only) showed positive correlation.

Case 6 showed very low egg production in three regions (ileum not counted); for the cæcum, 4 ova per gram per female, found in the transverse, and 8 ova per gram per female in the sigmoid, when the actual number of females recovered was 135. This was one of the cases likely to occur in field work, in which theoretical females would be (?) for the cæcum, 13 for the transverse, and 26 for the sigmoid.

Case 8 presented a very high count in all regions; namely, 712, 1,106, 1,720, and 362, for ileum, cæcum, transverse, and sigmoid, respectively, theoretically representing 65, 100, 157, and 33 females in the host, when the actual number recovered was 4—another type of case likely to be met in field work, as the case was beriberic and had some anæmia, œdema, and weakness of the lower extremities. It is possible that the perinephric abscess and confinement in bed had something to do with the increased count, indirectly.

Case 14 showed low egg counts in all four regions, being 20, 25, 25, and 10 ova per gram per female in the ileum, cæcum, transverse, and sigmoid, respectively; of course, the dehydration of stools higher up (the sigmoid excluded) in their course to the rectum will raise the number of ova per gram.

In these four cases without intestinal lesions, thirteen regions were surveyed and in only one (case 5) did the number of ova per gram show a valid positive correlation with the actual number of females recovered, or about 92 per cent lack of correlation by regions; low counts in two cases (3 and 14) and high in one (5), or lack of correlation in 75 per cent of the cases.

GROUP 3

Case 1 showed very poor egg production. Ova might have been lost in the fistula or ovoviviparity have taken place. Unfortunately, a count on the fistula stool was not made.

Case 2 showed good correlation in spite of the tumor and fistula. No count was made on the fistula stool.

Case 3 showed good correlation in typhoid with hæmorrhage.

Case 4 showed good correlation in acute catarrhal enteritis, had the females been recovered.

Case 9 gave very low egg counts in all regions, which may be due to the intestinal hæmorrhage, poor egg laying of females due to unfavorable intestinal contents, or ovoviviparity. The counts were (?), 6, 6, (?), ova per gram for ileum, cæcum, transverse, and sigmoid, respectively, per female recovered. There were 127 females actually found.

Case 10 gave very low egg counts in all regions (as did case 9) but associated with intestinal obstruction without fistula. The retention of fæcal matter in the jejunum either decreased egg production or destroyed the already discharged ova, or it may be that the worms were naturally poor egg layers.

Case 12 showed good correlation in spite of hæmorrhage.

Case 13 showed fair correlation.

Case 15 gave very low egg counts. Intestinal stasis, the rule in the insane in my post-mortem experience, might have hindered egg production, or the low count might have been due to the presence of many young and old nonegg-laying females or to naturally poor egg layers. The very low count in the dry rectal stools in the form of balls (300 ova per gram) suggests egg destruction.

Case 16 showed high counts in the cæcum and the transverse colon but (?) in the ileum and sigmoid. Possibly, the case being one of ptomain, or food, poisoning, she had vomiting and very frequent stools. The administration of large quantities of opiates stopped the intestinal peristalsis so rapidly that only few or no ova in diarrhoeal stools reached the recently emptied sigmoid and rectum. This may be the reason why no ova were seen in that region. The ova in the transverse and the cæcum were probably old extruded ova held in stagnant stools in the cæcum. The absence of ova in the ileal contents may be due to the kerosene and other unknown drugs taken by her, which acted on the ova already extruded, or on the females, thus

decreasing their production. The high counts in the cæcum and transverse seemed evidence of good egg-laying females, 190 and 125 ova per gram per female having been found in the cæcum and the transverse colon, respectively. Other data on these cases will be found in the tables.

Correlation is evident in about 50 per cent of the cases (2, 3, 4, 12, and 13) with intestinal pathology. This fact is significant and should be borne in mind in tropical countries where intestinal diseases are prevalent.

Correlation in cases without intestinal pathology was evident in four cases; namely, case 18 with 1 female worm, case 17 with 5 female worms, case 5 (sigmoid) with 2 female *Ancylostoma braziliense*, and case 11 in all regions except the cæcum, with 38 female worms. Negative correlation was evident in four cases; namely, case 7 with 83 female worms, case 14 with 30 female worms, case 8 with 4 female worms, and case 6 with 135 female worms. Closer correlation seemed more frequent with lower numbers of females.

It was noted that in seven cases without intestinal pathology three (cases 7, 11, and 8) had a high cæcum count and four (cases 17, 18, 6, and 14) either low (6 and 14) or normal (17 and 18) counts.

Perusal of the tables will show variabilities in the regional counts in the same case. The noted lack of correlation in three cases (6, 7, and 14) without intestinal pathology with many female worms may be due, in part, to uneven distribution of the worms in a long stretch of the small intestine. Thus, a variable number of ova is deposited in the contents of different regions and such contents reach the rectum without thorough mixing.

It is noted that in those cases (thirteen) in which regional counts were made there were no marked changes in the consistency of stools from the different regions of the colon. The ileal contents were mushy in all except cases 9 and 16. In case 10 the diarrhoeal nature of the colon contents might have been due to retained enema or to continued proctoclysis.

Evidence of the physiological dehydration of the stool in its course to the rectum was shown by the slightly higher counts in the rectal or sigmoidal than in the transversal stools of cases 6, 7, 17, and 18 (cases without intestinal pathology).

If in group 1 (deaths by violence or sudden deaths) the number of ova per gram per region of "formed basis" were all added (sixteen regions in four cases) and the number of fe-

male worms found in each case were multiplied by 4 (the four regions counted in each case) and added, we would have 44,275 ova and 498 female worms from sixteen regions, or 89 ova per female per gram of stool "formed basis."

If two regions were counted, the number of females from that case was multiplied by two, three regions by three, and so on. Thus, group 2 (deaths without intestinal pathology) case 5 excluded, would give 19,825 ova and 678 female worms from twelve regions, or 29 ova per female per gram of stool; group 3 (deaths with intestinal pathology) would give 28,650 ova and 2,701 female worms (twenty-eight regions), or 10 ova per female per gram of stool. The total for groups 1 and 2 (groups without intestinal pathology) was 64,100 ova and 1,176 female worms, or 54 ova per female. The totals for the three groups counted would be 92,750 ova and 3,877 female worms for fifty-six regions, or 24 ova per female per gram of stool "formed basis."

The above computations were made to match, in a measure, field conditions with morgue and laboratory findings, each intestinal region being represented by an individual. The above grouping and results of computations show how neutralization between high and low variants (shown in the preceding paper)² took place.

If the average number of ova in four regions per case were taken and divided by the number of female worms found in that case, the number of ova per female per gram of stool "formed basis" would be as follows:

Group 1:

- Case 7, 103 ova per female per gram of stool "formed basis."
- Case 11, 55 ova per female per gram of stool "formed basis."
- Case 17, 56 ova per female per gram of stool "formed basis."
- Case 18, 150 ova per female per gram of stool "formed basis."

Group 2 (only those counted regionally):

- Case 6, 4 ova per female per gram of stool "formed basis."
- Case 8, 976 ova per female per gram of stool "formed basis."
- Case 14, 20 ova per female per gram of stool "formed basis."

Group 3 (only those counted regionally):

- Case 9, 3 ova per female per gram of stool "formed basis."
- Case 10, 2 ova per female per gram of stool "formed basis."
- Case 12, no ova counted per gram of stool "formed basis."
- Case 13, 74 ova per female per gram of stool "formed basis."
- Case 15, 9 ova per female per gram of stool "formed basis."
- Case 16, 79 ova per female per gram of stool "formed basis."

² Antea p. 42.

According to the above data, group 1 showed variation of ova per female per gram of stool from 55 to 150; group 2, from 4 to 976; group 3, from 2 to 79.

It is interesting to note that in group 3 the two high egg outputs were from case 13 (amœbiasis) and case 16 (ptomain poisoning). Additional data on these cases will be found in the tables.

DISCUSSION OF TABLES

In Tables 1 to 18 will be found the history of each case, clinical observations, pathology, and other data actually noted by me while performing the autopsy.

Case 1, M. A., male, 22 years old, autopsy 492, January 15, 1925. Cause of death was intestinal obstruction and peritonitis due to faecal impaction 0.75 meter above the caecal valve. There were hard faeces in the entire colon. The patient was operated upon more than one week before death and a faecal fistula above the obstruction was established. Unfortunately, ovum counts were not made on the fistula stool. Probably eggs were discharged via the fistula, which would account for the low count. The low count is also evidence of mechanical obstruction which prevented the ova from getting into the colon. (See Table 1.)

TABLE 1.—Showing hookworm and ovum counts in case 1, sigmoidal or rectal stool.

Type of stool	Formed.
Ova per gram	75
Ova reduced to "formed basis"	75
Theoretical number of females	2
Actual females found (<i>Ancylostoma</i> , 5; <i>Necator</i> , 84)	89
Ova per gram "formed basis" per female found	1
Males found (<i>Ancylostoma</i> , 3; <i>Necator</i> , 100)	103

Case 2, C.F., male, 40 years old, autopsy 495, January 15, 1925. Cause of death, inanition due to lymphosarcoma of the jejunum and mesenteric glands. The correlation in this case is apparent in spite of the pathologic intestine and removal of the primary tumor one month before death, which resulted in a faecal fistula two weeks before death. Some ova might have escaped from the fistula. There was no peritonitis. (See Table 2.)

TABLE 2.—*Showing hookworm and ovum counts in case 2, sigmoidal or rectal stool.*

Type of stool	Formed.
Ova per gram	0
Ova reduced to "formed basis"	0
Theoretical number of females	?
Actual females found (<i>Ancylostoma</i> , 2; <i>Necator</i> , 1)	3
Ova per gram "formed basis" per female found	?
Males found (<i>Necator</i>)	3

Case 3, W.G., male, Chinese, 35 years old, autopsy 496, January 25, 1925. Cause of death, typhoid fever with intestinal hæmorrhage. Correlation apparent in spite of hæmorrhage. (See Table 3.)

TABLE 3.—*Showing hookworm and ovum counts in case 3, sigmoidal or rectal stool.*

Type of stool	Mushy.
Ova per gram	0
Ova reduced to "formed basis"	0
Theoretical number of females	?
Actual females found (<i>Ancylostoma</i>)	1
Ova per gram "formed basis" per female found	?
Males found (<i>Necator</i>)	1

Case 4, G.F., male, 1 year old, autopsy 498, January 29, 1925. Cause of death, acute catarrhal enterocolitis (nonspecific). Probably there was correlation, but the females were not recovered. (See Table 4.)

TABLE 4.—*Showing hookworm and ovum counts in case 4, sigmoidal or rectal stool.*

Type of stool	Mushy.
Ova per gram	375
Ova reduced to "formed basis"	750
Theoretical number of females	17
Actual females found (probably lost in the morgue or in faecal débris)	0
Ova per gram "formed basis" per female found (if only one female present)	750
Males found (<i>Necator</i>)	1

Case 5, A.A., female, 13 months old, autopsy 503, February 2, 1925. Cause of death, punctate hæmorrhages in the brain with congestion and œdema of the meninges (perhaps due to ascariasis). Case was admitted with convulsions. Correlation apparent. (See Table 5.)

TABLE 5.—Showing hookworm and ovum counts in case 5, sigmoidal or rectal stool.

Type of stool	Mushy.
Ova per gram	0
Ova reduced to "formed basis"	0
Theoretical number of females	?
Actual females found (<i>A. braziliense</i>)	2
Ova per gram "formed basis" per female found	?
Males found (<i>A. braziliense</i>)	1

Case 6, R.D., male, 19 years old, autopsy 499, January 29, 1925. Cause of death, anæmia and asphyxia due to massive pulmonary hæmorrhage from chronic ulcerative and miliary tuberculosis of both lungs. Stools contained tapioca and undigested vegetables. Only a couple of days in bed. The number of females recovered was very high compared with the theoretical number based on the egg count. This seems to be a case of poor egg laying on the part of the female worms. The alimentary tract was normal and the contents were not unusual. Low egg count may have been due also to bulky stool. (See Table 6.)

TABLE 6.—Showing hookworm and ovum counts in case 6.

	Stool from—				Total parasites.*	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma.</i>	<i>Necator.</i>
Type of stool		(b)	(b)	(b)		
Ova per gram.....	c 0	0	300	600		
Ova per gram reduced to "formed basis" (counted).....		0	600	1,200		
Theoretical number of females based on intestinal region count.....		(?)	13	26		
Actual females found.....					8	127
Ova per gram "formed basis" per female found by region.....		(?)	4	8		
Males found.....					5	123

* Total parasites found, 263; 128 males and 135 females. b Mushy. c Not counted.

Case 7, B.F., male, 28 years old, autopsy 500, January 31, 1925. Cause of death, acute anæmia due to suicidal stab wound, left chest, and lung with hæmothorax; died fourteen hours after incident. Subject well-developed and well-nourished farmer. Plenty of mushy stool containing plenty of grapefruit grains and vegetable débris. Strongyloid larvæ, 100 per gram of ileum content. A lower actual female count when

compared with the theoretical number based on rectum stool count. It coincided with the transverse colon count but was very low when compared with the cæcum and ileum counts. A case of good egg-laying females. There was plenty of stool in the colon. (See Table 7.)

TABLE 7.—*Showing hookworm and ovum counts in case 7.*

	Stool from—				Total parasites.*	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma</i> .	<i>Necator</i> .
Type of stool.....	(b)	(c)	(c)	(c)	-----	-----
Ova per gram.....	7,800	8,750	3,650	6,150	-----	-----
Ova per gram reduced to "formed basis"	15,600	8,750	3,650	6,150	-----	-----
Theoretical number of females based on intestinal region count.....	354	200	83	140	-----	-----
Actual females found.....					1	82
Ova per gram by region "formed basis" per female found.....	183	105	44	74	-----	-----
Males found.....					1	57

* Total parasites found, 141; 53 males and 88 females.

b Mushy.

c Formed.

Case 8, A.F., male, 21 years old, autopsy 501, February 1, 1925. Patient admitted for traumatic perinephric abscess (right), recovered, and then suffered pulmonary œdema. Autopsy showed marked cardiac dilatation with hypertrophy of both ventricular walls. About eight weeks before death a chenopodium treatment caused discharge of ten hookworms. A case with beriberic heart. This is also a case of good egg-laying females. The stools were not bulky. (See Table 8.)

TABLE 8.—*Showing hookworm and ovum counts in case 8.*

	Stool from—				Total parasites.*	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma</i> .	<i>Necator</i> .
Type of stool.....	(b)	(c)	(c)	(c)	-----	-----
Ova per gram.....	1,425	4,425	6,900	1,450	-----	-----
Ova per gram reduced to "formed basis"	2,850	4,425	6,900	1,450	-----	-----
Theoretical number of females based on intestinal region count.....	65	100	157	83	-----	-----
Actual females found.....						4
Ova per gram by region "formed basis" per female found.....	712	1,106	1,720	362	-----	-----
Males found.....						3

* Total parasites found, 7; 3 males and 4 females.

b Mushy.

c Formed.

Case 9, L.O., male, 22 years old, autopsy 502, February 3, 1925. Anatomical diagnosis, acute ulcerative enteritis with hæmorrhage (typhoid fever).

The low egg count in this case may be due to intestinal hæmorrhage, poor egg laying, or ovolysis. (See Table 9.)

TABLE 9.—Showing hookworm and ovum counts in case 9.

	Stool from—				Total parasites. ^a	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma.</i>	<i>Necator.</i>
Type of stool.....	(^b)	(^c)	(^c)	(^c)		
Ova per gram.....	0	375	375	0		
Ova per gram reduced to "formed basis".....	0	750	750	0		
Theoretical number of females based on intestinal region count.....	(?)	17	17	(?)		
Actual females found.....					1	126
Ova per gram by region "formed basis" per female found.....	(?)	6	6	(?)		
Males found.....					^d 2	60

^a Total parasites found, 189; 62 males and 127 females.

^b Diarrhœal.

^c Mushy.

^d One of these *Ancylostoma ceylanicum*? (*A. braziliense*). The opinion of most writers is that *A. ceylanicum* and *A. braziliense* are one and the same species.

Case 10, J.T., a Mohammedan Filipino, male, 31 years old, autopsy 505, February 5, 1925. Illness, about three days.

Autopsy findings, intestinal obstruction due to mesenteric band. Obstruction in the jejunum.

An illustration is here afforded of the possible influence of intestinal obstruction on decrease in the egg-laying ability of females or destruction of extruded ova. The patient was operated upon, but no fistula was established, as he was in a state of collapse and died a few minutes after the operation. (See Table 10.)

Case 11, P.C., multipara, 31 years old, autopsy 506, February 5, 1925. Acute anæmia due to postpartum hæmorrhage with retained placenta. Died soon after beginning of labor, without medical attendance outside the hospital. This is a case of fairly good correlation on the 44 ova per gram "formed basis" except in the cæcum count. (See Table 11.)

TABLE 10.—*Showing hookworm and ovum counts in case 10.*

	Stool from—				Total parasites.*	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma.</i>	<i>Necator.</i>
Type of stool.....	(b)	(c)	(c)	(c)		
Ova per gram.....	0	0	40	0		
Ova per gram reduced to "formed basis".....	0	0	160	0		
Theoretical number of females based on intestinal region count.....	(?)	(?)	4	(?)		
Actual females found.....					5	22
Ova per gram by region "formed basis" per female found.....	(?)	(?)	6	(?)		
Males found.....					2	8

* Total parasites found, 37; 10 males and 27 females. ^b Mushy. ^c Diarrheal.

TABLE 11.—*Showing hookworm and ovum counts in case 11.*

	Stool from—				Total parasites.*	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma.</i>	<i>Necator.</i>
Type of stool.....	(b)	(c)	(c)	(c)		
Ova per gram.....	600	4,350	1,650	1,200		
Ova per gram reduced to "formed basis".....	1,200	4,350	1,650	1,200		
Theoretical number of females based on intestinal region count.....	27	100	37	27		
Actual females found.....						38
Ova per gram by region "formed basis" per female found.....	32	114	43	32		
Males found.....					1	43

* Total parasites found, 82; 44 males and 38 females. ^b Mushy. ^c Formed.

Case 12, P.S., female, 17 years old, autopsy 507, February 5, 1925. Acute ulcerative enteritis with hæmorrhage (typhoid fever). A good correlation in a light infection, though the effect of the hæmorrhage on ova or worms could not be appraised. (See Table 12.)

Case 13, A.S., male, 50 years old, autopsy 509, February 7, 1925.

Postmortem findings, large amœbic "abscess" on the right lobe of the liver, communicating with the inferior lobe of the

right lung, and chronic ulcerative colitis (cæcum and ascending colon).

Pain in the right chest complained of for two months. No dysenteric complaint at any time. A good correlation in a light infection. Motile *Entamœba histolytica* were recovered from abscess contents. (See Table 13.)

TABLE 12.—Showing hookworm and ovum counts in case 12.

	Stool from—				Total parasites. ^a	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma.</i>	<i>Necator.</i>
Type of stool.....	(b)	(b)	(b)	(b)		
Ova per gram.....	0	0	0	0		
Ova per gram reduced to "formed basis".....	0	0	0	0		
Theoretical number of females based on intestinal region count.....	(?)	(?)	(?)	(?)		
Actual females found.....						2
Ova per gram by region "formed basis" per female found.....	(?)	(?)	(?)	(?)		
Males found.....						1

^a Total parasites found, 3; 1 male and 2 females.

^b Mushy.

TABLE 13.—Showing hookworm and ovum counts in case 13.

	Stool from—				Total parasites. ^a	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma.</i>	<i>Necator.</i>
Type of stool.....	(b)	(b)	(b)	(b)		
Ova per gram.....	150	0	75	225		
Ova per gram reduced to "formed basis".....	300	0	150	450		
Theoretical number of females based on intestinal region count.....	7	(?)	3	10		
Actual females found.....					1	2
Ova per gram by region "formed basis" per female found.....	100	(?)	50	150		
Males found.....					4	3

^a Total parasites found, 10; 3 males and 7 females.

^b Mushy.

Case 14, L.I., male, 32 years old, autopsy 510, February 9, 1925. Death was due to pneumococcic meningitis. Admission complaints, fever and severe headache. This case showed only a fair correlation on the 44 ova per gram "formed basis" per female, though still a low egg output. (See Table 14.)

TABLE 14.—*Showing hookworm and ovum counts in case 14.*

	Stool from—				Total parasites. ^a	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma.</i>	<i>Necator.</i>
Type of stool.....	(b)	(b)	(b)	(c)	-----	-----
Ova per gram.....	300	375	375	300	-----	-----
Ova per gram reduced to "formed basis".....	600	750	750	300	-----	-----
Theoretical number of females based on intestinal region count.....	14	17	17	7	-----	-----
Actual females found.....					1	29
Ova per gram by region "formed basis" per female found.....	20	25	25	10	-----	-----
Males found.....					2	10

^a Total parasites found, 42; 12 males and 30 females. ^b Mushy. ^c Formed.

TABLE 15.—*Showing hookworm and ovum counts in case 15.*

	Stool from—				Total parasites. ^a	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma.</i>	<i>Necator.</i>
Type of stool.....	(b)	(c)	(c)	(c)	-----	-----
Ova per gram.....	2,325	8,100	4,725	300	-----	-----
Ova per gram reduced to "formed basis".....	4,650	8,100	4,725	300	-----	-----
Theoretical number of females based on intestinal region count.....	106	187	107	7	-----	-----
Actual females found.....					10	460
Ova per gram by region "formed basis" per female found.....	10	17	10	1	-----	-----
Males found.....					8	367

^a Total parasites found, 845; 375 males and 470 females. ^b Mushy. ^c Formed.

Case 15, M.N.H., a tall, poorly nourished American, male, 44 years old, autopsy 511, February 11, 1925, acutely maniac for about one month. Discharged from United States Army about fourteen years ago. Autopsy showed marked meningeal congestion and oedema and small areas of meningeal and subdural hæmorrhages with sclerosis of the basilar arteries but normal aorta, kidneys, and liver. The entire colon contained not less than 2 kilograms of impacted fæcal matter in the form of smooth-surfaced balls slightly smaller than a baseball. These balls were dark gray and very easily reduced to pulp on crushing. Large and small *Necator* worms. A case of either very many young females or poor egg layers. The low count in the rectum

suggests destruction of ova in long-standing stool in "vivo." (See Table 15.)

Case 16, V.F., female, 37 years old, autopsy 512, February 13, 1925.

Cause of death, acute gastro-enterocolitis due to food poisoning. Vomiting and diarrhœa stopped three days before death. A case of apparent overproduction of ova. Liquid in the ileum and little stool in the sigmoid. Woman said to have been demented; drank plenty of "kerosene" and other unknown drugs. (See Table 16.)

TABLE 16.—Showing hookworm and ovum counts in case 16.

	Stool from—				Total parasites.*	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	Ancylostoma.	Necator.
Type of stool.....	(b)	(c)	(c)	(c)		
Ova per gram.....	0	2,250	1,500	0		
Ova per gram reduced to "formed basis".....	0	4,500	3,000	0		
Theoretical number of females based on intestinal region count.....	(?)	100	68	(?)		
Actual females found.....					2	22
Ova per gram by region "formed basis" per female found.....	(?)	190	125	(?)		
Males found.....					1	10

* Total parasites found, 35; 11 males and 24 females. b Diarrhœal. c Mushy.

Case 17, L.L., female, 52 years old, autopsy 513, February 14, 1925. Patient a well-developed and well-nourished female, up and about, though she had complained of occasional severe headache for several months. Then she had an attack of unconsciousness and died (out of hospital). Autopsy showed cerebral hæmorrhage left ventricle with arteriosclerosis, hypertrophy of the left ventricle, and chronic interstitial nephritis. This case could be considered a normal control. Fair correlation evident except in the sigmoidal stool. The higher number of ova may be due to lesser stool bulk or the extrusion of more ova at the time the worms were passed. (See Table 17.)

Case 18, M.A., a Mohammedan Filipino, male, 33 years old, autopsy 514, February 14, 1925. A very large and deep, incised wound was inflicted on the right side of the neck during his sleep (?) and he probably died in a few minutes. Internal organs were normal, outside of anæmia. This case could also be

considered a good normal control. Assuming the loss of a few females in screening the correlation could be made apparent. (See Table 18.)

TABLE 17.—*Showing hookworm and ovum counts in case 17.*

	Stool from—				Total parasites. ^a	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma</i> .	<i>Necator</i> .
Type of stool.....	(^b)	(^c)	(^c)	(^c)	-----	-----
Ova per gram.....	0	300	225	600	-----	-----
Ova per gram reduced to "formed basis".....	0	300	225	600	-----	-----
Theoretical number of females based on intestinal region count.....	(?)	7	5	14	-----	-----
Actual females found.....	-----	-----	-----	-----	-----	5
Ova per gram by region "formed basis" per female found.....	(?)	60	45	120	-----	-----
Males found.....	-----	-----	-----	-----	-----	6

^a Total parasites found, 11; 6 males and 5 females.

^b Mushy.

^c Formed.

TABLE 18.—*Showing hookworm and ovum counts in case 18.*

	Stool from—				Total parasites. ^a	
	Ileum.	Cæcum.	Transverse colon.	Sigmoid or rectum.	<i>Ancylostoma</i> .	<i>Necator</i> .
Type of stool.....	(^b)	(^b)	(^b)	(^b)	-----	-----
Ova per gram.....	0	75	75	150	-----	-----
Ova per gram reduced to "formed basis".....	0	150	150	300	-----	-----
Theoretical number of females based on intestinal region count.....	(?)	3 or 4	3 or 4	7	-----	-----
Actual females found.....	-----	-----	-----	-----	-----	1
Ova per gram by region "formed basis" per female found.....	(?)	150	150	300	-----	-----
Males found.....	-----	-----	-----	-----	0	0

^a Only one female parasite found.

^b Mushy.

SUMMARY

1. For the purpose of obtaining at least some explanation of the discrepancies noted between the number of ova per gram of stool "formed basis" and the number of females recovered by chenopodium treatment on a series of eighteen clinical cases previously reported, eighteen fresh cadavers were subjected to egg and worm counts. Five were used for sigmoidal or rectal

counts and thirteen for sigmoidal counts (ileum, cæcum, transverse, and rectum, or sigmoid).

2. The autopsy procedure is described and, in spite of the exercise of extreme care, the loss of a few worms must be assumed.

3. The egg-counting method used was essentially that of Stoll with slight unavoidable modifications, described in the preceding article.³

4. Of the eighteen cadavers, twelve were males and six females; the ages were from 17 to 52 years, except two infants, 12 and 13 months old. Fourteen were Christian Filipinos, two Mohammedan Filipinos, one an American, and one a Chinese.

5. In the interpretation of results, all stools were reduced to "formed basis" using Stoll's factors 1, 2, 4 for formed, mushy, and diarrhoeal stools, respectively.

6. The factor 44 ova per gram of formed stool per female was used throughout.

7. For pathological and biological reasons the cases were classified into three groups: Group 1, normal controls, four cases who died of violence or met sudden death; group 2, four cases whose death was not related to the alimentary tract, and in whom the intestines showed no pathology; and group 3, ten cases with intestinal pathology.

8. Of sixteen regions surveyed in group 1 six, or 38 per cent, had high egg counts. The other regions were either normal (around 44 ova per female) or had low counts.

9. Of the thirteen regions surveyed in group 2, 92 per cent by region and 75 per cent of the cases showed lack of correlation between the egg counts and the number of female worms found.

10. Positive correlation was evident in 50 per cent of the cases in group 3, cases with intestinal pathology.

11. In three out of seven cases without intestinal pathology, in whom regional counts were made, the cæcal counts were higher than the transversal.

12. Closer correlation was observed in cases with low female worm counts.

13. In thirteen cases counted regionally, no marked changes in the consistency of the stools in the three colon regions were noted in the same individual.

14. The sigmoidal or rectal egg count was slightly higher than the transversal in four cases without intestinal pathology and

³ Antea p. 36.

in a case of amœbiasis. Low counts were observed in two cases without intestinal pathology.

15. Group 1 had 89 ova per female per gram of stool "formed basis;" group 2 had 29 ova per female; and group 3 had 10 ova per female. The number of ova per female in each group was determined by adding the number of ova per gram in four regions counted in each case and multiplying by four the number of females found in that case. Then the total number of ova in sixteen regions (four cases) was divided by the total number of females in that group (the number of females in each case obtained as above). Where two regions were counted the number of females was multiplied by two, three regions by three.

16. By averaging the three groups in which fifty-six regions were counted, each female was represented by 24 ova per gram of stool, the result of neutralization.

17. When the average number of ova in four regions in each case was divided by the number of female worms actually found in that case, group 1 showed variation of from 55 to 150 ova per female per gram of stool "formed basis;" group 2, from 4 to 976 ova per female per gram of stool; and group 3, 2 to 79 ova per female per gram of stool "formed basis."

18. Variability in egg output noted in cases with a large number of females may be due to uneven distribution of female worms in a long stretch of the small intestine, the contents of which, carrying a variable number of ova, failed to mix in their course to the rectum.

19. The variability in the egg output of female hookworms as observed in passed stools may be due to mechanical influence, such as fæcal fistula and intestinal obstruction, stasis in the cæcum or elsewhere, good or poor egg-laying females, and egg destruction or ovoviviparity. Some intestinal factors that might influence egg laying and egg destruction were noted. It is likely that different races or strains of *Necator* have different egg-laying capabilities.

NEUE INDO-MALAYISCHE BORKENKAEFER (IPIDÆ) II. NACHTRAG

Von HANS EGGERS

Stolberg (Harz), Deutschland

In 1922 erschien mein erster Beitrag zur Borkenkäferfauna des ganzen Indo-Malayischen Gebietes,¹ von der Strasse von Singapore bis zu den Philippinen und über Neuguinea bis Nordaustralien, mit 127 Neubeschreibungen.

In der Treubia befindet sich inzwischen ein erster Nachtrag im Druck mit 23 neuen Arten aus dem engeren Gebiet der Sundainseln bis Südborneo und Neu Guinea. Ausserdem gebe ich dabei zahlreiche neue Fundorte aus dem ganzen Gebiet.

Sehr umfangreiche Sammlungen von den Philippinen und Nordborneo geben mir nun Material für einen zweiten Nachtrag, der sich nur mit diesem engeren Gebiet befasst. Der Hauptanteil des mir vorliegenden Materials besteht aus der Böttcherischen Ausbeute, die in den Jahren 1913 bis 1918 auf den Philippinen gesammelt wurde. Den grösseren Teil mit circa 2,400 Stück erwarb ich selbst; ein kleinerer Teil aus Nord Palawan wurde mir von Professor Linnaniemi, Turku, Finnland, zur Bestimmung vorgelegt.

Sehr schöne und vielseitige Collectionen legten wir zum Vergleich und Bestimmung vor Herrn Professor Charles F. Baker, Los Baños, und das Bureau of Science, Manila. Ein Teil davon ist noch nicht fertig bearbeitet und enthält noch weitere 30 neue Arten.

DIAMERUS STRIATUS sp. nov.

Längliche Körperform mit ziemlich parallelen Seiten, hell dicht beschuppt, auf den Flügeldecken durch die dunklen Punktstreifen gestreift erscheinend, auch Unterseite dicht hell beschuppt. Dunkelbraun, mässiger Glanz, soweit die Beschuppung die Oberfläche durchscheinen lässt.

Kopf bei allen Stücken einer zahlreichen Reihe gleichmässig flach gewölbt, dicht und kräftig punktiert mit feiner angedeuteter Linie auf der oberen Stirn und schmaler undeutlicher

¹ Zool. Med. Univ. Leiden (1922) Deel VII, 129-220.

Längsfurche über dem Munde. Zwischen Augen und Mund ist die untere Kopfhälfte dicht mit hellen länglichen Schuppen besetzt.

Halsschild etwas breiter als lang mit fast parallelen Seiten und gerundeten Vorderecken. Vorderrand gerade, keine Einschnürung hinter demselben; Oberseite sehr dicht und kräftig punktiert mit leicht angedeuteter Mittellinie und schwacher Seitenkante. Seiten und Basis der Oberfläche dicht mit nach der Mittellinie zu gerichteten keulenförmigen, langen, hellen Schuppen besetzt.

Flügeldecken kaum merklich breiter und 2.25 mal so lang als Halsschild, hinter der Basis etwas erweitert, dann leicht eingezogen, im letzten Drittel deutlich ausgebaucht und breit abgerundet, Naht bei zahlreichen Stücken nur etwas abgestumpft vorgezogen, bei anderen in eine scharfe Spitze ausgezogen (vielleicht Geschlechtsunterschied!). Oben flach und eben bis zum steil abgewölbten Absturz. Punktstreifen deutlich eingedrückt, infolge des ausgebauchten, gewölbten Absturzes hinten etwas nach auswärts gebogen. Zwischenräume flach, fein und deutlich punktiert und dicht mit hellen, anliegenden, länglichen Schuppen besetzt, nur auf dem zweiten Zwischenraume ist in der Mitte ein grösserer Fleck dunkelbrauner Schuppen, der auch unregelmässig auf den dritten und vierten Zwischenraum übergreift.

Länge, 3 bis 3.5 Millimeter.

Fundort, Philippinen: MINDORO, San Teodoro; Sammler *Böttcher*; Typen in Sammlung Eggers.

DIAMERUS PUNCTICOLLIS sp. nov.

Eine grössere Art, in der Form dem *D. striatus* sp. nov. ähnlich, jedoch nicht beschuppt, sondern lang und dicht anliegend behaart. Dunkelbraun, mässig glänzend, heller rotbraun behaart, Unterseite hell behaart.

Kopf dicht punktiert, beim Mann zwischen den Augen ausgehöhlt, beim Weib flach gewölbt, fein und dicht behaart.

Halsschild breiter als lang, gut gewölbt, seitlich wenig gebogen und Vorderecken abgerundet. Oberseite dicht mit ziemlich grossen, tiefen Punkten bedeckt und mit braunen, ziemlich langen Haaren besetzt. Angedeutete, feine, erhabene Mittellinie. Unterseite unterhalb der schwach ausgebildeten Seitenkante mit kleinen Büscheln feiner, heller Härchen besetzt.

Flügeldecken fast doppelt so lang wie Halsschild und kaum breiter als dieses. Hinten nach der Naht zu leicht abgerundet

ohne Ausbauchung. Naht zu schwacher Spitze vorgezogen. Oberseite gestreift punktiert, Zwischenräume flach, dicht punktiert und anliegend, ziemlich lang, braun behaart in unregelmässigen, dichten Reihen. Seitenkante vor der Schulterbeule eckig vorgezogen.

Länge, 4 bis 4.8 Millimeter.

Fundort, Philippinen: LUZON, Provinz Rizal, Montalban: Provinz Laguna, Los Baños. MASBATE, Aroroy. Je 1 Stück (2 Männer, 1 Weib); Sammler *Böttcher*; in Sammlung Eggers.

NEGRITUS MAJOR sp. nov.

Etwas grösser als die beiden beschriebenen Arten, gekennzeichnet durch mehrreihige Schuppen auf den Flügeldecken und schmalere, grosse, längliche Fühlerkeule. Schwarz, mässig glänzend, plump gebaut.

Kopf gewölbt, dicht und fein punktiert mit kleinem Höcker auf der Stirn. Fühlerkeule schmal beginnend und etwas schief, keulenförmig abgerundet.

Halsschild stark gewölbt, breiter als lang, eben vor der Basis am breitesten, nach hinten wenig verschmälert, nach vorn stärker verengt und abgerundet. Vorderrand in der Mitte leicht eingezogen. Höckerfleck, mit einzeln stehenden, ziemlich kräftigen Höckern, berührt den Vorderrand nicht, geht nach hinten bis über die Mitte; hinteres Drittel stark runzelig gekörnt. Schildchen breit, in der Mitte vertieft.

Flügeldecken etwas schmaler und um $\frac{1}{4}$ länger als das Halsschild; wie bei den anderen Arten gerundet. Die Naht selbst hinter dem Schildchen bis zur Mitte vertieft. Punktreihen deutlich vertieft. Die breiten Zwischenräume dicht punktiert und mehrreihig mit unter sich gleichen, hellen, anliegenden Schuppen bedeckt. Am Absturz die Naht etwas erhöht.

Länge, 2.5 bis 2.6 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Surigao, Surigao. BASILAN. Sammler, *C. F. Baker*; 2 Stück in Sammlung Eggers.

NEGRITUS MINOR sp. nov.

Ein zierlicher, fein skulptierter Käfer von schmalerer Form. Dunkelbraun mattglänzend, fein punktiert, mit feinen Schüppchen bedeckt.

Kopf glänzend, sehr fein punktiert, mit feinen Haaren über dem Munde; Fühlerkeule lang, keulenförmig, sehr gross, ungegliedert, fein kurz grau behaart.

Halsschild länger als breit, vor der Basis am breitesten, nach vorn langsam verschmälert und abgerundet, am Vorderrand mit

vier Höckern besetzt. In der Mitte quer gebuckelt, nach vorn abschüssig, mit regelmässig gestellten Höckern versehen, hinten dicht und fein punktiert ohne glatte Mittellinie. Hinterrand doppelt eingebuchtet. Schildchen erhaben, weil die Flügeldecken rundum etwas eingedrückt sind.

Flügeldecken wenig schmaler und um $\frac{1}{8}$ länger als das Halsschild. Punktreihen leicht vertieft mit kleinen Punkten. Zwischenräume äusserst fein und dicht punktiert, mit einer Mittelreihe grösserer, absteigender Schuppen in feiner dichter Grundbeschuppung.

Länge, 1.7 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Zamboanga, Port Banga. Sammler, *Böttcher*; 1 Type in Sammlung Eggers.

HYLESINUS PERSIMILIS sp. nov.

Nahe verwandt mit *H. papuanus* mihi. Schwarz, matt glänzend, schmal gebaut, flach gewölbt.

Kopf fein und dicht punktiert mit schmaler, feiner Mittellinie über dem Munde; beim Mann hier mit flachem Eindruck, beim Weib leicht gewölbt.

Halsschild ebenso lang wie breit, seitlich im Bogen nach vorn verschmälert, ohne Einschnürung hinter dem Vorderrande; Winkel an der Basis nach hinten ausgezogen, parallel zur Basis leicht eingedrückt; fein und dicht, flach punktiert ohne Mittellinie; seitlich ein Feld vom Vorderrand bis zum Hinterrande mit zerstreuten, feinen Körnchen bedeckt. Schildchen fast kreisrund.

Flügeldecken von gleicher Form wie bei *papuanus*, doch nach kurzer Wölbung noch schräger abfallend. Punktreihen tragen deutlich getrennte, längliche Punkte. Zwischenräume flach, dicht punktiert und viel spärlicher mit kurzen braunen Borsten besetzt als bei *papuanus*.

Länge, 2 bis 2.4 Millimeter.

Fundort, Philippinen: MINDORO, Provinz Mindoro, Calapan; Sammler, *Webb*; je 2 Typen, in Sammlung Eggers und Sammlung Bureau of Science, Manila.

SPHAEROTYPES BICOLOR sp. nov.

In die nächste Verwandtschaft des *S. quadrituberculatus* Sampson gehörig, auch ohne erhabene Leisten auf den Zwischenräumen, jedoch mit anders verteilten Höckern. Halsschild zweifarbig, schwarz und hellgrau, Flügeldecken schwarzbraun, matt.

Kopf zwischen den Augen abgeflacht, hellgrau, ganz kurz behaart, darüber ein Bogen mit sehr kurzer, schwarz-samtener Behaarung.

Halsschild breiter als lang, in der Mitte der Basis nach hinten vorgezogen, Seitenrand scharf gekantet, im Bogen nach vorn gerundet; hinter dem ersten Drittel nach den beiden Vorder-ecken hin eine flache Rille. Der von diesen beiden Rillen und dem Vorderrande eingefasste Kreisabschnitt und eine bis zur Mitte der Basis reichende schmale Verlängerung dieses Fleckes samtig schwarz, das übrige Halsschild scharf abgesetzt silbrig grau. Vorn spärlich und fein, hinten dichter und kräftiger punktiert. Vor dem Hinterrand auf beiden Seiten drei steife, helle Borsten.

Flügeldecken breiter als Halsschild und lang oval gebaut. Punktreihen gestreift und mit länglichen Punkten. Hinter der niedrigen Höckerreihe des Vorderrandes dicht unregelmässig gerunzelt, der Nahtzwischenraum einreihig, die übrigen vorne doppelreihig punktiert und fein beschuppt, der dritte, fünfte, und siebente auf dem Absturz mit zerstreuten, mässig grossen Höckern besetzt, die übrigen mit einzelnen kleinen Körnchen. Vor dem Ende des zweiten Zwischenraumes steht ein grösserer Höcker. Von *quadituberculatus* verschieden durch tiefere Punktstreifen, gewölbtere Zwischenräume, stärkere Höcker. Die seitlichen Punktstreifen 8 und 9 gehen durch die Schulterbeule und sind vorne in Doppelcurve geschwungen; bei der anderen Art beginnt Punktstreifen 8 erst hinter der Schulterbeule und 9 zeigt an der Basis nur einen einfachen Bogen.

Länge, 3 Millimeter.

Fundort, BORNEO, Sandakan, von *Baker* gesammelt; 1 Weib, Type, in Sammlung Eggers.

SPHAEROTYPES CARINATUS sp. nov.

Ein kleinerer Käfer mit scharf gekielten Rippen auf den Flügeldecken und zwei stärkeren Höckern am Hinterrand; schwarz, das Halsschild ausser dem Vorderrand rotbraun, ebenso die Gliedmassen.

Stirn flach, äusserst fein punktuiliert mit kleinem Höcker über dem Munde.

Halsschild mattglänzend, fein hautartig genetzt und zerstreut fein punktuiliert; der seitliche Eindruck hinter dem Vorderrande ist nur schwach. Der schwarze Streifen hinter dem Vorderrande ist in der Mitte schmal vorgezogen bis zur Mitte des Hals-

schildes. Vor der nur mässig nach hinten gezogenen Mitte des Hinterrandes eine angedeutete feine Mittellinie.

Flügeldecken etwa doppelt so lang wie das Halsschild und etwas breiter als dieses; tief gestreift mit feinen Reihenpunkten. Zwischenräume vorne sehr breit, flach, punktiert und runzelig gehöckert, dann zu einer schmalen Kante hoch gekielt, auf dem Absturz weniger scharf mit feinen Körnchen, einreihig, ziemlich weitläufig, hell beschuppt. Am Ende des dritten und sechsten Zwischenraumes steht je ein kräftiger Höcker.

Länge, 2.4 Millimeter.

Fundort, BORNEO, Sandakan, Sammler *Baker*; 1 Weib, Type, in Sammlung Eggers.

SPHAEROTYPES BOETTCHERI sp. nov.

Am nächsten verwandt mit *S. blandfordi* Schaufuss aus Burma; in Grösse, Form, und Skulptur der Flügeldecken kaum unterschieden. Schwarzbraun mit schwarzem Kopf, matt, Halsschild mässig glänzend, Flügeldecken ohne Leisten und Höcker.

Kopf oben fein genetzt, Stirn über den Augen im Dreiecke kurz samtartig behaart, zwischen den Augen spärlich kurz behaart, Augen grösser als bei *S. blandfordi*, mit abgerundeten Ecken.

Halsschild breiter als lang, nach hinten weniger tief vorgezogen, mattglänzend, hellgrau mit schwarzem Streifen hinter dem Vorderrande. An beiden Seiten hinter dem Vorderrande eine tiefe Linie eingedrückt. Seitenkante scharf gerandet. Oben fein hautartig genetzt, fein punktiert; in den Punkten stehen feine, kurze Schüppchen. Bei *blandfordi* ist die Oberseite stark und dicht körnelig gerunzelt und trägt eine erhabene Mittellinie und erhabenen Hinterrand, welche bei *boettcheri* fehlen.

Flügeldecken breiter als Halsschild, schön oval geformt, in Streifen punktiert, die breiten flachen Zwischenräume runzelig gekörnt und unregelmässig in drei Reihen mit länglichen, anliegenden Schuppen bedeckt. Vorderrand mit breiten Höckern, dahinter grobrunzelig quer gehöckert. Auf Scheibe und Absturz weder Leisten noch grössere Höcker, nur vor dem Hinterrand auf dem zweiten und dritten Zwischenraume eine kleine Querleiste.

Unterseite fein, kurz grau behaart.

Länge, 4 Millimeter.

Fundort, Philippinen: MINDORO, Subaan, von *Boettcher* gesammelt; 1 Weib, Type, in Sammlung Eggers.

SPHAEROTRYPES BANGENSIS sp. nov.

Zu den grösseren Arten gehörig, mit Rippen auf den Zwischenräumen der Flügeldecken und grossen Hinterrandhöckern. Kopf und breiter Halsschildvorderrand schwarz, übriges Halsschild rotbraun, Flügeldecken schwarzbraun. Kopf über den Augen schwarz, fein punktiert, kahl, zwischen den Augen fein, kurz grau beschuppt. Mann über dem Munde flach quer eingedrückt; Weib eben, mit kleinem, glatten Längshöcker.

Halsschild breiter als lang, Eindruck seitlich hinter dem Vorderrande sehr flach, Oberseite fein punktiert und spärlich, fein, hell beschuppt. Schildchen schmal und lang.

Flügeldecken breiter als Halsschild und fast doppelt so lang, nach hinten stärker verschmälert und stark abfallend. Hinter dem schwach gehöckerten Vorderrande breit unregelmässig gerunzelt. Punktreihen tief gestreift und dicht gross punktiert. Zwischenräume 2 bis 6 in der vorderen Hälfte kielartig erhaben, und zweireihig punktiert, die seitlichen vorne mehrreihig punktiert, alle hinten einreihig, ziemlich dicht mit mässig grossen Höckern besetzt und ganz mehrreihig beschuppt, der Nahtzwischenraum einreihig punktiert und beschuppt. Der dritte und sechste Zwischenraum endigen in einen starken Höcker.

Länge, 3.5 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Zamboanga, Port Banga; Sammler *Böttcher*; eine Reihe in Sammlung Eggers.

SPHAEROTRYPES MOSERI sp. nov.

In den Hauptmerkmalen wie *S. bangensis* sp. nov. Er unterscheidet sich durch die etwas tiefer ausgehöhlte Stirn des Mannes, das Fehlen des schwachen Stirnhöckers beim Weib.

Flügeldecken tragen ebenfalls auf dem zweiten bis sechsten Zwischenraume rippenartige Erhöhungen hinter dem quengerunzelten Vorderteil. In der hinteren Hälfte tragen aber nur der dritte, fünfte, und siebente Zwischenraum grosse, weitläufige Höcker, während dieselben bei *S. bangensis* klein und dicht gestellt auf allen Zwischenräumen sind. Die beiden grossen Hinterrandhöcker haben die gleiche Stellung vor dem dritten und sechsten Zwischenraum. Das Weib ist schwächer gehöckert als der Mann.

Länge, 3.5 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Zamboanga, Port Banga; Provinz Surigao, Surigao; Sammler *Böttcher*, in Sammlung Eggers: Provinz Lanao, Kolambugan, Sammler *Banks*, in derselben Sammlung und im Bureau of Science, Manila.

Von einer dieser beiden Arten besitze ich auch Frasstücke in der Rinde einer mir unbekannten Holzart, welche ähnlich wie die von Strohmeier abgebildeten des *S. philippinensis* sind.²

SPHAEROTRYPES INSULARIS sp. nov.

Kleiner und schmaler als *S. böttcheri*, in Farbe und Skulptur des Halsschildes, auch in den Schuppen der Flügeldecken sehr ähnlich. Die Basis der Flügeldecken nur fein gekörnt, die Zwischenräume weiterhin nicht gekörnt, sondern mehrreihig unregelmässig punktiert, im hinteren Teil dicht einreihig schwach gehöckert mit Ausnahme des ersten, zweiten, und vierten. Vor dem Ende des siebenten Zwischenraumes ein kräftiger Höcker, vor dem dritten und vierten eine starke Querleiste, welche am Ende des vierten einen Höcker trägt. Die Zwischenräume tragen dieselben Schuppen wie *S. böttcheri*.

Länge, 3 Millimeter.

Fundort; Philippinen: MINDANAO, Provinz Lanao, Kolambungan, 1 Weib, Type, in Sammlung Eggers.

SPHAEROTRYPES PALAWANUS sp. nov.

In Skulptur, Form, und Farbe nahe verwandt mit *S. globulus* Blandford, *pila* Blandford, und *coimbatoensis* Stebbing. Von letzterem unterscheidet ihn das seitlich hinter dem Vorderrande nicht eingeschnürte Halsschild; dagegen haben beide Arten den ersten Punktstreifen neben dem Schildchen parallel zur Naht nach vorn durchgeführt. *Sphaerotrypes pila* hat einen flacheren Winkel am hinteren Halsschildrande und die ersten Punktstreifen neben der Naht laufen vorn in der Mitte des Schildchens zusammen; *S. globulus* endlich, den Beeson³ mit *coimbatoensis* vereinigen will, ist von allen drei Arten deutlich unterschieden durch ein auffallend langes und schmales Schildchen, hat dagegen gemeinsam mit *palawanus* die etwas stärker ausgeprägte Punktierung des Halsschildes.

Schwarz, matt, Zwischenräume auf den runzelig punktierten Flügeldecken mit drei bis fünf Reihen bräunlicher Schuppen bedeckt, ohne vortretende Höcker oder Leisten.

Länge, 2.4 bis 2.8 Millimeter.

Fundort, Philippinen: PALAWAN, Binaluan. Sammler Böttcher; 2 Typen in Sammlung Linnaniemi, Turku, Finnland, und Sammlung Eggers.

² Philip. Journ. Sci. § D 6 (1911) Tafel 1.

³ Ind. For. (1921) 514. Ich besitze Typen von *S. pila* und *globulus* und sichere Stücke von *coimbatoensis* zum Vergleich.

PHLOEOSINUS IMITANS sp. nov.

Nahe verwandt mit *P. latus* mihi von Sumatra, doch gröber in der Skulptur. Kurz oval, gelbbraun, mattglänzend.

Kopf sehr fein punktiert, zwischen Augen und Mund mit einzelnen gröberen Punkten durchsetzt, beim Mann leicht eingedrückt, kurz behaart. Augen tief geteilt, beide Teile ziemlich weit getrennt und nur durch eine schmale Linie am oberen Rand verbunden (auch bei *P. latus* ist diese feine Verbindung beider Augenteile vorhanden!); Augen grösser und breiter als bei *P. latus*.

Halsschild breiter als lang, stark gerundet und nach vorn verschmälert, jedoch nicht eingeschnürt hinter dem Vorderrande; dicht und deutlich punktiert, Punkte nicht tief. In der hinteren Hälfte eine schmale, nach vorn verbreiterte und abgeflachte Mittellinie (auch bei *latus* ist diese vorhanden!).

Flügeldecken so breit wie das Halsschild und um $\frac{1}{3}$ länger als dieses, breit abgerundet; Vorderrand leicht erhaben und krenuliert. Punktstreifen vertieft mit grossen, länglichen Punkten, Zwischenräume breit, vorne flach mit Querrunzeln und feinen Höckerchen, die vom ersten Viertel an kräftiger werden; in der hinteren Hälfte sind die Zwischenräume stärker gewölbt, die Höcker auf dem ersten und dritten stärker; auf dem zweiten und vierten erlöschen sie auf dem Absturz ganz, auf dem sechsten fast ganz. Der achte Zwischenraum hat in der Mitte eine schwache, kurze Kante, der neunte hinten eine ausgeprägte Seitenkante. Flügeldecken tragen feine, kaum sichtbare Grundbehaarung und einzelne längere Haare.

Länge, 3.2 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Kolambugan, Sammler *Banks*; je 1 Type in Sammlung Bureau of Science, Manila, und Sammlung Eggers.

CRYPTHALOMORPHUS BANGENSIS sp. nov.

Gedrungenere Form als *C. buruensis* mihi. Braun, mässig glänzend, fein und dicht behaart und beschuppt.

Kopf fein genetzt, über dem Munde spärlich und sehr fein gekörnt.

Halsschild kaum länger als breit, von den fast geraden Hinterecken an fast gleichmässig allmählich abgerundet, vor der Mitte kaum merklich verschmälert. Basis leicht gerandet; Vorderrand in der Mitte etwas vorgezogen und mit vier Höckern besetzt. Höckerfleck ist gross und besteht aus ziemlich kräftigen Breithöckern. Hinter demselben nur wenig einge-

drückt. Hintere Hälfte seitlich und vor dem Hinterrande dicht punktiert, in der Mitte leicht und fein gekörnt und mit hellen Schuppen dicht besetzt. Schildchen gross.

Flügeldecken so breit und 1.5 mal so lang wie Halsschild, hinten halbkreisförmig gerundet. Ueber die ganze Fläche gleichmässig dicht und ziemlich fein punktiert; Punktreihen sind nicht zu unterscheiden. Zwischenräume dicht mit feiner, kurzer Grundbehaarung bedeckt und mit einer Mittelreihe kurzer, kräftiger Schuppen besetzt. Oben gleichmässig gewölbt, ohne Eindruck hinter dem Schildchen oder an der Naht.

Länge, 1.6 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Zamboanga, Port Banga, 29. Dezember, 1924. Sammler *Böttcher*; Typen in Sammlung Eggers.

CRYPHALOMORPHUS MINOR sp. nov.

Kleinere, gedrungene Form, braun, fein und dicht behaart, mässig glänzend.

Kopf leicht gewölbt, fein und dicht punktiert und fein und kurz behaart.

Halsschild so lang wie breit, von den Hinterecken an leicht gerundet verschmälert; Vorderrand leicht vorgezogen und mit einer dichten Reihe äusserst feiner Körnchen besetzt. Vordere Hälfte sehr fein gehöckert; hintere Hälfte fein und dicht punktiert und gekörnt. Hinter dem Höckerfleck seitlich leicht eingedrückt.

Flügeldecken von gleicher Form und Längenverhältnis wie bei der grösseren Art *C. bangensis*, ohne Eindruck neben Schildchen oder Naht. Punktreihen kaum zwischen den feinen dichten Punkten der Zwischenräume zu erkennen. Die kräftig abgerundeten und abgewölbten Flügeldecken dicht mit feiner kurzer Grundbehaarung und Reihen längerer Haare bedeckt.

Länge, 1.1 Millimeter.

Fundort, Philippinen: LUZON, Manila, 8. November, 1914; Sammler *Böttcher*; Typen in Sammlung Eggers.

CRYPHALUS MINIMUS sp. nov.

Ein sehr kleiner, cylindrisch, aber gedrunge gebauter, glänzender Käfer, pechbraun mit hellen Gliedmassen und dunkler Fühlerkeule.

Kopf gewölbt, fein punktiert, beim Mann mit feinen, ziemlich langen Querkel oberhalb der Augen.

Halsschild so lang wie breit, mit abgestumpften Hinterecken, fast parallelen Seiten, vor der Mitte breit abgerundet. Dicht

hinter dem Vorderrande sechs feine Körnchen. Höckerfleck besteht aus verhältnismässig grossen, ziemlich regelmässig gestellten, niedrigen Höckern. Hintere Hälfte fein punktiert, jederseits mit einer kleinen, glatten Schwiele. Basis fein gerandet.

Flügeldecken kaum breiter und etwa 1.5 mal so lang wie das Halsschild, fast parallelseitig und hinten im Halbkreis gerundet. Oberseite äusserst fein, scheinbar unregelmässig dicht punktiert und mit feiner, mit Lupe kaum wahrnehmbarer, anliegender Grundbeschuppung versehen, in der, wohl auf den Zwischenräumen, in weiten Abständen einzelne steife Borsten stehen.

Länge, 0.8 Millimeter.

Fundort, Philippinen: LUZON, Provinz Camarines Sur, Mount Isarog; Sammler *Böttcher*; Typen in Sammlung Eggers.

STEPHANODERES BAKERI sp. nov.

Eine der grössten bisher beschriebenen Arten, ausgezeichnet durch nur abwechselnd beborstete Zwischenräume der Flügeldecken. Dunkelbraun, matt infolge rauher Skulptur, spärlich lang behaart, von lang ovaler, kräftiger Form.

Kopf gewölbt, dicht punktiert, beim Mann über den Augen mit einer glänzenden, unten in der Mitte ausgerandeten Querschwiele. Augen gross, tief ausgerandet; Fühlergeissel 4-gliedrig, Keule gross mit vier hell und dicht behaarten, doppelt geschwungenen Nähten.

Halsschild wenig breiter als lang, Seiten in der hinteren Hälfte fast parallel und deutlich gerandet, auch die Basis etwas verengt, Mitte des Vorderrandes etwas vorgezogen und mit zwei starken, etwas zurückgebogenen Höckern besetzt, daneben jederseits einige kleinere Höcker. Fast die ganze Oberseite mit Höckern besetzt, die vorne gross, nach hinten immer schwächer und weitläufiger werden. Die Vorderhüften gross, kugelig, abstehend lang beborstet. Schildchen unsichtbar.

Flügeldecken ebenso breit und gut um die Hälfte länger als das Halsschild, mit anfangs parallelen Seiten, bald verschmälert und breit abgerundet. Naht im ersten Drittel eingedrückt. Punktreihen eigentümlich flach gerunzelt, die breiten, leicht gewölbten Zwischenräume runzelig, abwechselnd (1, 3, 5 usw.) mit einer weitläufigen Reihe langer, dunkler Borsten besetzt.

Grösse, 2.5 Millimeter.

Fundort, Philippinen: CATANDUANES, Provinz Albay, Virac; Sammler *Böttcher*; Typen und eine grössere Reihe in Sammlung Eggers. Herrn Professor Charles F. Baker gewidmet.

IPS PHILIPPINENSIS sp. nov.

Dem *Ips perexiguus* Blandford von den Damma Inseln sehr ähnlich in Gestalt, Bezählung und Skulptur, braun mit helleren Gliedmassen.

Kopf glänzend, dicht punktiert, eine sehr fein erhabene Längslinie auf der Stirn; Geschlechtskennzeichen an der Stirn nicht vorhanden.

Halsschild um mehr als die Hälfte länger als breit, bis über die Mitte heraus parallelseitig, vorne kräftig gerundet, Basis fast gerade, Hinterecken nicht abgerundet. In den vorderen zwei Fünfteln fein gekörnt, in den hinteren drei Fünfteln gleichmässig sehr fein gepunktet, ohne die glatte Mittellinie und Seitenflecken des *I. perexiguus*.

Flügeldecken gleich breit und mehr als die Hälfte länger (bei *perexiguus* "rather more than a third longer") als das Halsschild, parallelseitig; Punkte der Reihen, an der Basis sehr fein, werden bis zum Absturz gross und tief. Zwischenräume fein, aber deutlich, etwas weitläufiger punktiert, in der hinteren Hälfte deutlich behaart. Absturz wie bei *perexiguus* gebildet, bei dem Mann mit zwei kräftigen Zähnen auf dem zweiten und vierten Zwischenraum und einen kleinen Randhöcker gleich unter dem zweiten Zahn. Das Weib trägt die zwei feinen Zähnchen am verengten und nicht tief ausgehöhlten Absturz wie *perexiguus*.

Länge, 1.5 bis 1.8 Millimeter.

In Anzahl in Böttcher's Ausbeute; Frasstücke in unbekannter Holzart zeigen feine Sterngänge mit sehr langen Armen.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Momungan; Kolambugan. MINDORO, Mangarin. MASBATE, Aroroy. SIARGAO, Dapa. BASILAN. LUZON, Subprovinz Benguet, Baguio; W. Schultze.

IPS BISPINOSUS sp. nov.

Am nächsten verwandt mit *Ips insularis* mihi von den Key Inseln. Braun, glänzend, walzenförmig, deutlich punktiert, ziemlich lang behaart.

Kopf leicht gewölbt, fein und dicht punktiert, lang behaart. Augen breit, nierenförmig. Nähte der Fühlerkeule gerade.

Halsschild um die Hälfte länger als breit, mit hinten parallelen Seiten; vor der Mitte langsam verschmälert. Vordere Hälfte gleichmässig fein gehöckert, hinten fein und dicht punktiert.

Flügeldecken ebenso breit und um $\frac{1}{3}$ länger als das Halsschild; bei beiden Geschlechtern ganz parallelseitig, am Absturz

nicht verengt. Punktreihen mit deutlichen, nach hinten stärker werdenden Punkten, die erste neben der Naht nicht vertieft. Die glatten Zwischenräume tragen nur einzelne feine Pünktchen. Absturz ziemlich steil, mit ausgeprägtem Rand und schwach erhabener Naht, ziemlich gross und tief punktiert und lang behaart. Absturz beim Mann leicht ausgehöhlt, beim Weib flach. Die Zwischenräume enden auf dem Rande in vorspringende Höcker, von denen der vierte beim Mann durch einen langen kräftigen, mit der Spitze nach innen gebogenen Zahn ersetzt wird. Beim Weib sind die Höcker schwächer, der Zahn ist nicht vorhanden, jedoch trägt die flache Absturzfläche in der Höhe des vierten Zwischenraumes in der Mitte zwischen Naht und Rand einen deutlichen, kleinen, kegelförmigen Höcker.

Länge, 1.5 bis 1.8 Millimeter.

Fundort, Philippinen: MINDORO, Mangarin; Sammler Böttcher; Typen in Sammlung Eggers.

IPS TUBERCULATUS sp. nov.

In der Grösse der *Ips laricis*-Gruppe nahestehend; er gehört aber in die Untergattung *Ips* s. str. Dunkelbraun, glänzend, Flügeldecken stark skulptiert, schwach behaart.

Kopf leicht gewölbt, dicht punktiert, beim Mann ein schwaches Körnchen über dem Munde; spärlich lang behaart. Fühlerkeule mit einer kreisförmig gebogenen Naht.

Halsschild länger als breit, hinten mit parallelen Seiten, vor der Mitte merklich verschmälert und abgerundet. Oben im vorderen Drittel schwach gehöckert, in dem grösseren hinteren Teil deutlich und dicht punktiert.

Flügeldecken um die Hälfte länger als Halsschild, parallelseitig, hinten kurz gerundet. Punktreihen grob und tief punktiert, die erste merklich eingedrückt. Seitliche Zwischenräume tragen in der hinteren Hälfte vereinzelt feine Punkte, sonst glatt. Erster und zweiter Zwischenraum tragen vor dem Absturz eine kurze Reihe kräftiger, weitläufig gestellter Höcker. Absturz glänzend, kräftig punktiert, Naht erhaben. Nahtzwischenraum ohne Suturalzähnen. Zweiter Zwischenraum trägt vor dem Absturz ein kräftiges, der dritte ein schwächeres Zähnchen, der vierte einen dreieckigen starken, hinten senkrecht abfallenden Zahn. Unter diesem im oberen Teile des ganzrandigen Seiten- und Hinterrandes ein paar kleine Höcker. Einzelne lange Haare. Der Absturz des Weibes trägt die gleiche Bezahnung, nur schwächer, jedoch ist die grosse Lücke zwischen dem ersten und dritten Zahn des Mannes beim Weib weniger auffallend, weil das

zweite Zähnnchen hier stärker ausgebildet ist und die Lücke füllt.

Länge, 3 bis 3.4 Millimeter.

Fundort, Philippinen: MINDORO, Mangarin; Sammler *Böttcher*; Typen in Sammlung Eggers.

IPS BICAUDATUS sp. nov.

Ein eigenartiger Käfer, in seiner Gattung allein stehend durch zwei breite, schneidezahnartige Fortsätze des Hinterrandes der Flügeldecken. Klein, braun, glänzend, ziemlich fein punktiert, spärlich lang behaart.

Kopf stark glänzend, dicht und deutlich punktiert, ohne Geschlechtsabzeichen.

Halsschild um $\frac{1}{3}$ länger als breit, hinten parallelseitig, vor der Mitte wenig verschmälert und breit abgerundet, Basis gerade, Hinterecken nicht abgerundet. Vorne sehr schwach gebuckelt, mit feinen Höckern regelmässig besetzt, hintere Hälfte fein und dicht punktiert, glänzend; feine, schmale, nicht erhabene Mittellinie nur angedeutet.

Flügeldecken ebenso breit und zwei Drittel so lang als Halsschild, parallelseitig bis zum Absturz, hier wenig verschmälert. Reihenpunkte ziemlich fein, nach hinten nicht gröber werdend und nicht sauber gereiht. Punktreihen sind nicht vertieft. Zwischenraumpunkte feiner und spärlich, Nahtzwischenraum vor dem Absturz runzelig, die anderen glatt. Der ziemlich steile, bei Mann und Weib gleichmässig ausgehöhlte Absturz ist deutlich gerandet und trägt auf dem zweiten Zwischenraum einen kleinen, auf dem vierten einen sehr kräftigen, dahinter einen kleinen Höcker und weiter unten noch zwei gleiche. Dann folgt am Hinterrande ein breiter, kräftiger Fortsatz auf jeder Flügeldecke, zwischen denen ein breiter, rechtwinkliger Zwischenraum neben der Naht entsteht. Beim Weib sind die Zähne schwächer, der Fortsatz des Hinterrandes aber gleich stark ausgebildet. Absturz glänzend, dicht punktiert, Naht nicht erhaben.

Länge, 1.8 bis 2 Millimeter.

Fundort, Philippinen: BASILAN; Sammler *Böttcher*; eine Reihe in Sammlung Eggers.

THAMNURIDES CURTUS sp. nov.

Von ähnlich gedrungener Form wie *T. sundaensis* mihi und *ternatensis* mihi, aber stärker gewölbt; braun, glänzend, lang behaart.

Kopf leicht gewölbt, fein punktiert; über dem Munde flach eingedrückt, mit angedeuteter Längslinie. Augen von vorne zum Teil sichtbar.

Halsschild leicht gewölbt, wenig länger als breit, nach vorne verschmälert; fein punktiert, mit feinen Körnchen und langen Haaren weitläufig besetzt, seitlich und hinten deutlich gerandet.

Flügeldecken etwa 1.5 mal so lang und ebenso breit wie Halsschild, parallelseitig, stark gewölbt, hinten breit abgerundet; Punktreihen tragen deutliche, dicht aber nicht ganz regelmässig gestellte Punkte, Zwischenräume breit, flach, mit einzeln stehenden feinen Punktkörnchen, welche lange, abstehende Haare tragen. Absturz flach gedrückt, ohne vertiefte Punktreihen. Vorderschienen mit drei kräftigen Aussenzähnen, während die Aussenkante von *T. sundaensis* deren vier zeigt.

Länge, 2.1 Millimeter.

Fundort, Philippinen: MINDANAO, Agusan River; Sammler C. M. Weber; je 2 Typen im Bureau of Science, Manila, und Sammlung Eggers.

THAMNURGIDES CALAPANUS sp. nov.

Von der gedrungenen, kräftigen Form des *T. sundaensis* mihi, *curtus* mihi, und *myristicae* Roepke.

Kopf, flach gewölbt, fein längs gestrichelt, mit schwachem, schmalen Längskiel.

Halsschild wenig länger als breit, Hinterecken abgestumpft, Seiten wenig ausgebaucht, nach vorne etwas verschmälert und dann abgerundet. Oben gleichmässig gewölbt und ziemlich dicht mit sehr kleinen, flachen, runden Höckerchen bedeckt, zwischen denen unregelmässig einzelne etwas stärkere Höcker zerstreut sind. Zerstreut, ziemlich lang, abstehend behaart.

Flügeldecken kaum merklich breiter und um die Hälfte länger als das Halsschild, die Seiten nach hinten fast etwas divergierend, dann kräftig abgerundet. Oben flach gewölbt, im letzten Drittel ziemlich steil abgewölbt, ohne Eindruck. Punktreihen tragen ziemlich kräftige, nicht ganz regelmässig gereihte, dichtstehende Punkte. Die Reihen sind nicht vertieft. Die flachen Zwischenräume sind halb so dicht wie die Punktreihen mit etwas schwächeren Punkten besetzt die lange Haare tragen. Die Vorderschienen tragen an der Aussenkante drei Zähne.

Länge, 2.4 Millimeter.

Fundort, Philippinen: MINDORO, Calapan; Sammler Böttcher; 1 Type in Sammlung Eggers.

THAMNURGIDES PUNCTATUS sp. nov.

Von etwas längerer Form als *T. sundaensis*, aber gedrungener als die *T. vulgaris*-Verwandten, weil hinten stark gerundet. Dunkelbraun, mässig glänzend, lang abstehend behaart.

Kopf gewölbt, längs gestrichelt, mit erhabenem Längskiel.

Halsschild kaum länger als breit, nach vorn eiförmig verschmälert mit deutlichem Seitenrande und weniger deutlichem Hinterrande. Flach gewölbt, mit dichten Höckerchen besetzt, dazwischen fein punktiert, lang abstehend behaart.

Flügeldecken ebenso breit und fast doppelt so lang wie das Halsschild, parallelseitig, hinten kurz und breit gerundet; oben ziemlich stark gewölbt, hinter der Mitte nach hinten abgewölbt, Absturz flach gedrückt. Punktreihen tragen grosse, kräftige, nicht auffällig dicht gestellte Punkte. Dagegen stehen die deutlichen, lang behaarten Körnchen auf den Zwischenräumen dichter als bei den meisten anderen Arten.

Länge, 2.2 Millimeter.

Fundort, Philippinen: MINDORO, Subaan, 30. Januar, 1916, Sammler *Böttcher*; 1 Type in Sammlung Eggers.

THAMNURGIDES STRIATUS sp. nov.

Von der länglichen Form des *T. vulgaris* mihi. Braun, glänzend, lang einzeln behaart.

Kopf flach gewölbt, fein und spärlich punktiert, Augen zum Teil von vorne sichtbar. Halsschild länger als breit, flach gewölbt, fein und spärlich punktiert, ohne Körnchen, glänzend.

Flügeldecken etwa 1.5 mal so lang und ebenso breit wie das Halsschild, hinten nicht so breit abgerundet wie die meisten Arten. Oben flach, gleichmässig nach hinten abgewölbt; in deutlichen, etwas vertieften Reihen kräftig und ziemlich dicht gestreift punktiert. Zwischenräume flach und glatt, mit feinen Körnchen mässig dicht besetzt und lang behaart.

Länge, 1.8 Millimeter.

Fundort, Philippinen: LUZON, Provinz Laguna, Mount Maquiling; Sammler *Baker*; 1 Type in Sammlung Eggers.

THAMNURGIDES DEPRESSUS sp. nov.

Von eigenartig hinten verbreiteter Form, mit scharfem Hinterrand der Flügeldecken, braun, glänzend, lang behaart.

Kopf leicht gewölbt, fein punktiert, Augen zum Teil von vorne sichtbar.

Halsschild flach, von der üblichen, kurz ovalen Form, spärlich fein punktiert und lang behaart, ohne deutliche Körnchen oder Höcker.

Flügeldecken 2.5 mal so lang wie Halsschild, schon an der Basis breiter als dieses, nach hinten langsam verbreitert und sehr kurz gerundet mit scharfem Hinterrand, welcher sich seitlich nach vorn hochzieht. Oben flach gewölbt, nach hinten abgeschrägt und vor dem Hinterrande leicht quer eingedrückt. Fein und flach in den Reihen punktiert, mit äusserst feiner, mikroskopisch kurzer Behaarung. Die Zwischenräume kaum sichtbar punktiert mit lang abstehender Behaarung. Aussenkante der Vorderschienen trägt drei dichtstehende kräftige Zähne.

Länge, 1.6 Millimeter.

Fundort, Philippinen: LUZON, Provinz Laguna, Mount Maquiling; Sammler *Baker*; 1 Type in meiner Sammlung.

POECILIPS OBLONGUS sp. nov.

Der Gattungstyp *P. sannio* Schauffuss aus Westafrika am ähnlichsten, aber länger gebaut; pechschwarz, Flügeldecken in der vorderen Hälfte pechbraun, nach hinten allmählich dunkler werdend, mit gelbbraunen Gliedmassen, glänzend; ziemlich lang spärlich behaart.

Kopf flach gewölbt, dicht punktiert mit leicht erhabener, glatter Längsschwiele auf der Stirn; über dem Munde ein Büschel anliegender goldgelber Haare.

Halsschild flach gewölbt mit nicht scharfer Seitenkante; vor den leicht abgerundeten Hinterecken im flachen Bogen nach vorn verschmälert und abgerundet; oben in der vorderen Hälfte mit flachen Höckern besetzt, hinten fein punktiert, einzeln lang behaart.

Flügeldecken doppelt so lang und reichlich so breit wie das Halsschild, parallelseitig bis zum letzten Fünftel, dann abgerundet; deutliche Schulterbeule; oben flach gewölbt, ziemlich steil abfallend; mit ziemlich grossen runden Punkten in flachen Reihen punktiert, Zwischenräume mit feinen Punktkörnchen, vorn weitläufig, auf dem Absturz dichter besetzt und auf diesem mässig lang, hell behaart.

Länge, 1.8 bis 2 Millimeter.

Fundort, Philippinen: LUZON, Mount Polis; Sammler *Böttcher*; Type in Sammlung Eggers.

POECILIPS LONGIOR sp. nov.

Dem *P. oblongus* sp. nov. ähnlich, aber in der Gestalt schmaler und länger, matter im Glanz, pechschwarz, mit gelbbraunen Gliedmassen, kürzer behaart.

Kopf dicht punktiert mit schwach erhabener Mittellinie wie bei *P. oblongus*.

Halsschild gut um die Hälfte länger als breit, mit abgerundeten Hinterecken, fast parallelseitig, vor der Mitte verschmälert abgerundet. Nur hinter dem Vorderrand leicht flach gehöckert, die andern zwei Drittel des Halsschildes fein punktiert mit unpunktierter Mittellinie.

Flügeldecken fast doppelt so lang und wenig breiter als das Halsschild, parallelseitig bis zum letzten Viertel, dann zur Naht hin abgerundet, beim Weib auffallend breiter gerundet. Punkttierung von Reihen und Zwischenräumen wie bei *oblongus*, Behaarung wenig kürzer.

Länge, 1.6 bis 1.8 Millimeter.

Fundort, Philippinen: LUZON, Provinz Mountain, Balbalan; Sammler *Böttcher*; Type in Sammlung Eggers.

POECILIPS BREVIOR sp. nov.

Eine breite und flache Form, vorne und hinten mehr verschmälert als die anderen Arten; pechbraun mit etwas helleren Gliedmassen, glänzend mit hellen, steifen Börstchen.

Kopf dicht punktiert mit flacher Mittellinie auf der Stirn und einigen langen Haaren.

Halsschild fast so breit wie lang mit gerundeten Hinterecken, gleichmässig nach vorn gerundet und verschmälert; Vorderrand kräftig gerundet. Oben ziemlich flach, vorne klein und flach gehöckert, im letzten Drittel punktiert, mit flacher, angedeuteter, glatter Mittellinie.

Flügeldecken wenig breiter und etwa 1.75 so lang wie das Halsschild an der Basis, bis zu zwei Drittel der Länge parallelseitig, fast etwas verbreitert, dann stark verschmälert und abgerundet. Oben flach, abwärts flach abgewölbt. Punktreihen mit grossen, runden Punkten und mikroskopisch feinen, kurzen Härchen. Zwischenräume breit mit dichter gestellten, feinen Punktkörnchen und steiferen, mässig langen, hellen Haaren.

Länge, 1.7 bis 2 Millimeter.

Fundort, Philippinen: LUZON, Provinz Mountain, Balbalan; Sammler *Böttcher*. 1 Stück von SUMATRA; Typen in Sammlung Eggers.

POECILIPS MEDIUS sp. nov.

Kräftiger, cylindrisch gebauter Käfer, pechschwarz mit pechbraunen Gliedmassen, glänzend, ziemlich lang behaart.

Kopf dicht punktiert mit schmaler, erhabener Linie auf der Stirn, über dem Munde leicht eingedrückt, lang hell behaart.

Halsschild wenig länger als breit, stärker gewölbt als bei den anderen Arten, hinten parallelseitig mit kaum abgestumpften Hinterecken, vorne allmählich verschmälert und kurz gerundet, seitlich gekantet. Die ganze Oberfläche mit Ausnahme einer schmalen Mittellinie mit flachen Höckern bedeckt.

Flügeldecken fast doppelt so lang als das Halsschild und kaum breiter als dieses; parallelseitig, hinten kurz gerundet, deutliche Schulterbeule, oben stark gewölbt und hinten steil abfallend. Punktreihen tragen grosse, runde Punkte mit äusserst feinen, kurzen Härchen, die Zwischenräume feine Punktkörnchen mit langen, hellen Haaren.

• Länge, fast 2 Millimeter.

Fundort, Philippinen: LUZON, Provinz Camarines Sur, Mount Isarog; Sammler *Böttcher*; Typen in Sammlung Eggers.

POECILIPS PUNCTATUS sp. nov.

Von den fünf Philippinen-Arten die am stärksten punktierte, pechbraun, stark glänzend, mit ziemlich langer, spärlicher Behaarung.

Kopf stark punktiert mit schmaler, etwas erhabener Mittellinie.

Halsschild um ein Viertel länger als breit, kaum abgestutzte Hinterecken, von der Basis an gleichmässig gerundet verschmälert. Vorne flach gehöckert, hinten deutlich punktiert, mit schmaler, nicht erhöhter Mittellinie.

Flügeldecken kaum breiter als das Halsschild und fast doppelt so lang wie dieses, parallelseitig, von zwei Drittel der Länge an stärker verschmälert als die anderen Arten. Punktreihen mit kräftigen, tiefen, runden Punkten, die erste mit besonders grossen Punkten. Zwischenräume daher schmal, weitläufig mit feinen Punkten und ziemlich langen Haaren besetzt.

Länge, 1.6 Millimeter.

Fundort, Philippinen: MINDORO, Subaan; Sammler *Böttcher*; Typen in Sammlung Eggers.

PELICERUS ELONGATUS sp. nov.

Lang schmal cylindrisch, braun, glänzend.

Kopf (Mann) eben, matt, fein punktiert, gleichmässig kurz behaart; Kopf (Weib) glänzend, leicht gewölbt, fein punktiert, unbehaart.

Halsschild gut um die Hälfte länger als breit, parallelseitig, im vorderen Viertel verschmälert abgerundet, fein punktiert.

Flügeldecken so breit und 1.75 mal so lang wie das Halsschild, ganz parallelseitig, schmal. Punktreihen tragen ziemlich feine Punkte, Zwischenräume sehr fein punktulierte; erste Punktreihe kaum vertieft, auch auf dem Absturze nicht deutlicher. Einige sehr feine Höckerchen auf den Zwischenräumen des Absturzes. Hinterrand nicht hervortretend.

Länge, 1.8 Millimeter.

Fundort, Philippinen, Typen: MINDANAO, Provinz Lanao, Kolambagan, 1 Mann, Sammler *Böttcher*. NEGROS, Provinz Occidental Negros, Fabrica, Sammler *Schultze*; in Sammlung Eggers; 1 Cotype von letzterem Fundort in Sammlung Bureau of Science, Manila.

Ein grösseres Weib von MINDORO, Subaan, in meiner Sammlung, scheint mir auch zu dieser Art zu gehören.

PELICERUS BREVIOR sp. nov.

Cylindrisch, glänzend, braun.

Kopf (Mann) eben, ohne Vertiefung, matt, fein punktiert, lang behaart; (Weib) leicht gewölbt, glänzend, fein punktiert, spärlich kurz behaart.

Halsschild kaum 1.25 mal so lang als breit, fast von der Basis an verschmälert, hinten ziemlich kräftig punktiert, ohne Mittellinie.

Flügeldecken 1.5 mal so lang und ebenso breit wie das Halsschild; parallelseitig, hinten breit abgerundet, Absturz ziemlich steil, mit ziemlich deutlichem Hinterrand. Punktreihen dicht mit mässig grossen Punkten besetzt, Zwischenräume ebenfalls sehr dicht und fein punktiert. Erste Punktreihe kaum stärker hervortretend, nur etwas vertieft auf dem Absturze. Hier die Zwischenräume mit feinen Höckerchen und einzelnen längeren Haaren weitläufig besetzt.

Länge, 1.8 bis 2 Millimeter.

Typen: Philippinen, MASBATE, Aroroy. LUZON, Provinz Nueva Vizcaya, Imugan. MINDANAO, Provinz Lanao, Kolambagan; Sammler *Böttcher*; in Sammlung Eggers. An letzterem Fundort sammelte ihn auch *Banks*. Cotypen in Sammlung Bureau of Science, Manila.

PELICERUS PHILIPPINENSIS sp. nov.

Cylindrisch, glänzend, braun.

Kopf (Mann) eben mit einer runden, flachen Vertiefung in der Mitte, matt, fein punktiert, am Rande lang gelb behaart; (Weib) gewölbt, glänzend, stärker punktiert, unbehaart.

Halsschild 1.5 mal so lang wie breit, in der hinteren Hälfte parallelseitig, vor der Mitte leicht verschmälert und vorne breit abgerundet; ziemlich kräftig punktiert, ohne glatte Mittellinie.

Flügeldecken ebenso breit und etwa 1.5 mal so lang wie Halsschild; parallelseitig, hinten ganz kurz und breit abgerundet, Absturz ziemlich steil. Punktreihen tragen grosse, ziemlich weitläufige Punkte, die Punkte der ersten Reihe noch grösser, diese Reihe etwas vertieft, besonders am Absturz. Zwischenräume tragen sehr feine, weitläufige Pünktchen, auf dem Absturze einige feine Höcker und längere Haare. Hinterand kaum angedeutet.

Länge, 1.8 bis 2 Millimeter.

Fundort, Philippinen: CATANDUANES, Provinz Albay, Virac, 14. März, 1916; Sammler *Böttcher*; Typen in Sammlung Eggers. Ferner 1 Stück von BASILAN.

OZOPEMON SIMILIS sp. nov.

Kurze gedrungene Form aus der Verwandtschaft des *O. fuscicollis* Hagedorn, braun, mässig glänzend, dicht und mässig lang behaart.

Kopf leicht gewölbt, fein punktiert, mit fein angedeuteter Mittellinie im unteren Teile, einzeln lang behaart.

Halsschild viel breiter als lang, mit fast rechtwinkligen Hinterecken, im hinteren Drittel parallelseitig, dann leicht verschmälert abgerundet; Mitte des Vorderrandes abgestutzt, wodurch die Breite des Halsschildes noch mehr hervortritt. Leichter Querbuckel hinter der Mitte, vorn fein und dicht gehöckert, hinten fein und dicht punktiert; einzeln lang behaart, besonders vorn und an den Seiten.

Flügeldecken ebenso breit und doppelt so lang wie das Halsschild, hinten breit und kurz abgerundet; oben leicht gewölbt, Absturz glatt abgewölbt, nur in der Mitte kreisförmig leicht abgeflacht. Ueber die ganze Fläche gleichmässig dicht und fein punktiert, ohne dass Zwischenräume und Punktreihen

zu unterscheiden sind. Zwischenräume mässig lang und dicht behaart; zweiter und vierter Zwischenraum tragen mehrreihige, die andern fast einreihige Haare, die nur wenig über die Grundbehaarung hervorragen. Vorderschienen mit drei schwachen Seitenzähnen.

Länge, 3.5 Millimeter; Breite an Flügeldeckenbasis, 1.8.

Fundort, BORNEO, Sandakan; Sammler *Baker*; 3 Typen in Sammlung *Baker* und *Eggers*.

NEOXYLOCTONUS PUSILLUS sp. nov.

Klein, graubraun, mattglänzend, unbehaart.

Kopf gewölbt, breit, matt, ohne erkennbare Punktierung, grau; die schwarzen Augen nicht ganz geteilt, beide Hälften durch eine sehr schmale Brücke verbunden.

Halsschild gross, kugelig, breiter als lang, gleich vor der Basis im Halbkreis gerundet. Hinter dem Vorderrand ein schmaler Streifen eingedrückt, sodass das Halsschild etwas gewölbt übersteht. In diesem schmalen Streifen vorne zwei kleine Höcker, seitlich in ziemlichen Abständen von einander eine Reihe Punkte. In dem Höckerfleck der vorderen Hälfte ein flacher Längseindruck; hinten dicht runzelig. Schildchen auffällig gross.

Flügeldecken so breit und um die Hälfte länger als das Halsschild, gleichmässig verschmälert gerundet, im letzten Drittel schräg nach der Naht verengt. Punktreihen mit flachen, ziemlich weitläufigen Punkten, die Reihen wenig vertieft. Zwischenräume flach mit äusserst feiner Punktulierung. Der erste verbindet sich am Ende mit dem neunten, der, vor dem Hinterrande etwas schärfer ausgeprägt, sich nach der Naht hinzieht, dritter und vierter etwas verkürzt, der achte verbindet sich mit dem siebenten, sechsten, und zweiten.

Länge, 1.2 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Kolambugan. MINDORO, San Teodoro. Sammler *Böttcher*; Typen in Sammlung *Eggers*.

XYLEBORUS BIMACULATUS sp. nov.

Weib.—Von der kurzen Form des *X. solidus* Eichhoff mit grossem, kugelförmigen Halsschild und kurz abgewölbten Flügeldecken; schwarz, glänzend, mit je einem grossen, gelben Fleck auf den Flügeldecken, ganz unbehaart, matt glänzend.

Kopf dicht runzelig punktiert mit einzelnen Körnchen; über dem Munde eine Reihe gelber Haare.

Halsschild gross, kugelig gewölbt mit scharfer Seitenkante; hinten parallelseitig, vorne im Kreisbogen gerundet mit zwei vorstehenden, spitzen Höckern in der Mitte des Vorderrandes. Im ersten Drittel kräftig gehöckert, im zweiten Drittel fein, dicht runzelig gehöckert, im letzten dicht und kräftig punktiert. Vor dem Schildchen eine kurze, dichte, schwarze Haarbürste. Schildchen klein, aber deutlich.

Flügeldecken so breit und lang wie Halsschild, von der Basis an im Bogen abgerundet, Absturz leicht abgeflacht mit scharfem Hinterrand. In der vorderen Hälfte äusserst fein in Reihen punktiert, aber nicht vertieft, die breiten Zwischenräume tragen nur einzelne, äusserst feine Pünktchen. Auf dem Absturze sind die ersten Punktreihen leicht vertieft. Die hintere Aussenhälfte der Flügeldecken von der zweiten Punktreihe an nimmt ein grosser, fast dreieckiger, gelber Fleck mit abgerundeten Ecken ein.

Länge, 3 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Iligan; 1 Stück, in Sammlung Eggers.

XYLEBORUS IMPAR sp. nov.

Mann.—Braun, länglich, mässig glänzend, dicht, fein und lang abstehend behaart, mit auffallend langem Halsschild.

Kopf leicht gewölbt, breit, hautartig genetzt, dicht und zwar im oberen Teile feiner, im unteren runzelig und gröber punktiert, mit feiner Mittellinie im oberen Teile.

Halsschild fast um die Hälfte länger als an der Basis breit, Hinterrand in der Mitte leicht nach vorn ausgebuchtet, Hinterecken gerundet, Seiten im hinteren Drittel leicht verschmälert, dann bis zum vorderen Drittel kräftig erweitert und vorn sehr breit abgerundet, so dass der Vorderrand nur ganz leicht gebogen ist. Oben in der Quere leicht gewölbt, in der Länge fast eben bis weit vor die Mitte, ohne Buckel, dann breit abgewölbt zum Vorderrande. Vorne dicht und fein gehöckert, hinten dicht und fein punktiert, Behaarung in der vorderen Hälfte nach hinten gekämmt. Schildchen sehr klein.

Flügeldecken so breit wie Halsschildbasis und kaum so lang wie Halsschild, parallelseitig mit abgerundeten Schultern, vom zweiten Drittel im Bogen abgerundet. Oben in einem flachen Bogen, der am Absturz etwas stärker wird, abfallend, in der ersten Hälfte die Naht und Umgebung flach längs eingedrückt. Absturz gleichmässig gewölbt, ohne deutlichen Hinterrand.

Reihen mit flachen, undeutlichen Punkten leicht eingedrückt, Zwischenräume breit, unregelmässig dicht mit feinen Punktkörnchen und lang abstehenden, auf dem Absturz nach vorn gekämmten Haaren besetzt. Vorderschienen aussen stark gebogen und mit sechs kräftigen Zähnen besetzt.

Länge, 4 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Kolambugan; Sammler *Böttcher*; Typen in Sammlung Eggers.

XYLEBORUS HYBRIDUS sp. nov.

Weib.—Wohl dem mir unbekannten *X. semirudis* nahestehend; doch unterscheidet ihn sicher die grössere Länge der Flügeldecken im Verhältnis zum Halsschild. Pechschwarz, ziemlich breit und mässig gewölbt, mässig glänzend, zwei Drittel der Flügeldecken matt, fein und spärlich behaart.

Kopf leicht gewölbt, mattglänzend mit stark glänzendem, schwach erhabenen Fleck über dem Munde, seitlich fein punktiert.

Halsschild breiter als lang, mit fast geraden Hinterecken und Seiten, nach vorne kaum verschmälert und dann breit abgerundet. Oben mässig gewölbt, mit schwachem Buckel in der Mitte; im ersten Drittel mässig dicht und nicht sehr kräftig gehöckert, im zweiten fein matt gerunzelt, hinten mässig glänzend und, mit guter Lupe kaum sichtbar, fein punktiert.

Flügeldecken so breit, und 1.75 mal so lang wie das Halsschild, bis hinter die Mitte leicht verbreitert und hinten sehr breit abgerundet mit deutlich ausgeprägtem Hinterrande. Oberseite gleich hinter der Basis kurz ansteigend, dann gleichmässig flach abgewölbt, im letzten Drittel neben der Naht leicht längs eingedrückt. Das vordere Fünftel und die Seiten bis unter den hochgezogenen Hinterand sind mattglänzend. Punkte der Reihen ziemlich gross, flach und dicht gestellt, flache Zwischenräume glatt, unpunktirt und ohne Höcker. Die übrige Fläche ist matt, Punktreihen deutlich sich abhebend, die flachen Zwischenräume tragen eine Reihe feiner Körnchen, auf den ersten drei Zwischenräumen stehen diese Körnchen weitläufig in Entfernungen von drei Reihenpunkten, auf den seitlichen enger in Entfernung von je zwei Reihenpunkten und tragen feine, lange Haare. Vorderschienen gerundet und sägeartig dicht gezähnt.

Länge, 3 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Momungan. MINDORO, Subaan. LUZON, Mount Banahao; Sammler *Böttcher*; Typen in Sammlung Eggers.

XYLEBORUS SORDICAUDULUS sp. nov.

Nahe verwandt mit *X. sordicauda* Eichhoff (Motschulsky), jedoch wesentlich kleiner, schlanker, stärker punktiert, mit anders geformtem Halsschild und Flügeldeckenabsturz. Von gestreckter, paralleler Form, dunkelbraun, glänzend.

Kopf kräftig und dicht punktiert, mit erhöhtem, glänzenden Kiel über dem Munde, daneben flach eingedrückt.

Halsschild so lang wie breit, Hinterecken gerundet, Seiten fast parallel, nach vorne nicht verschmälert, breit abgerundet, Mitte des Vorderrandes gerade abgestutzt. Oben mit kräftigem Querbuckel, vorne dicht gehöckert, hinten glänzend, kräftig und dicht punktiert. Schildchen gross, dreieckig, viel länger als breit, wie bei *X. sordicauda*.

Flügeldecken so breit und gut doppelt so lang wie Halsschild, parallelseitig, hinten breit gerundet mit deutlichem, aber nicht überstehenden Hinter- und Seitenrand. Vorderes Drittel gewölbt, aber nicht so stark gebuckelt wie bei *X. sordicauda*. Bei diesem fällt das zweite Drittel nach scharfem Knick ziemlich steil ab, bei *X. sordicaudulus* ist der Uebergang ganz allmählich in das flach gewölbte Mittelstück und nur etwa das letzte Viertel ist quer eingedrückt. Erstes Drittel stark glänzend mit kräftigen Punktreihen und etwas gewölbten, schwächer punktierten Zwischenräumen; der Rest der Flügeldecken mässig glänzend, die flachen Zwischenräume sehr dicht runzelig und ziemlich stark punktiert, mässig glänzend, weil nicht so dicht, wie bei *X. sordicauda* mit feinen, grauen Schuppen besetzt.

Länge, 2.5 Millimeter.

Fundort, Philippinen: PALAWAN, Binaluan; Sammler Böttcher; Typen in Sammlung Linnaniemi (Turku, Finnland) und Eggers.

XYLEBORUS MARGINATUS sp. nov.

Weib.—Eine Ersatzform des *X. sordicauda* (Motschulsky) auf den Philippinen, von geringerer Grösse und von der schmäleren Form des *X. sordicaudulus* sp. nov. der auf der Insel Palawan (Binaluan) (coll. Linnaniemi, Turku, Finnland) vorkommt. Braun, glänzend, letzte zwei Drittel der Flügeldecken dicht grau beschuppt.

Kopf fein und dicht punktiert, ohne deutlichen Kiel und seitlichen Eindruck über dem Munde.

Halsschild etwas nach vorn verschmälert, Mitte des Vorderrandes nicht gerade abgestutzt, sonst wie bei *X. sordicaudulus*. Schildchen viel breiter als lang.

Flügeldecken gut doppelt so lang und ebenso breit wie Halsschild, hinten breit gerundet mit scharf ausgezogenem und überstehendem Hinterrand, der seitlich bis zur Mitte vorgezogen ist und hier die Flügeldecken breiter erscheinen lässt als an der Basis. Skulptur etwas feiner, Beschuppung dichter, Punkte der Zwischenräume spärlicher und feiner als bei *X. sordicaudulus*. Nach dem ersten Drittel beginnt der Absturz mit deutlichem Bruch, Mittelstück fast eben, infolgedessen ist der Eindruck vor dem Hinterrande nicht so auffällig wie bei *X. sordicaudulus*.

Länge, 2.5 Millimeter.

Fundort, Philippinen: MINDORO, Subaan; Sammler *Böttcher*; 1 Type in Sammlung Eggers. LUZON, Subprovinz Benguet, Mount Santo Tomas; Sammler *Schultze*. Cotypen in Sammlung Bureau of Science, Manila, und Sammlung Eggers.

XYLEBORUS INDICUS SUBCORIACEUS var. nov.

Weib.—In der langen, cylindrischen Form mit breitgerundeten beiden Körperenden dem typischen Exemplar in Eichhoff's Sammlung durchaus gleich, ebenso in allen Einzelheiten; nur zeigt diese Varietät keinen Glanz. Die ganze Oberseite ist fein hautartig genetzt und matt. Ein Stück von den Philippinen, Mount Santo Tomas; Sammler *Schultze*. Cotypen in Sammlung; 3 andere Stücke von den Philippinen aus der *Böttcher*'schen Ausbeute zeigen keine Abweichung von der Stammform.

XYLEBORUS CUNEOLUS sp. nov.

Weib.—Gedrungenere Käfer mit hinten stark verengten Flügeldecken aus der Verwandtschaft des *X. cuneatus* Eichhoff; dunkelbraun, mattglänzend, schwach skulptiert, ziemlich lang grau behaart.

Kopf nicht zu erkennen, weil bei dem Einzelstück in das Halsschild zurückgezogen.

Halsschild so lang wie breit, mit geraden Hinterecken, bis vor die Mitte parallelen Seiten, dann im Kreisbogen abgerundet. Vorderrand mit fünf feinen Körnchen; oben eben hinter der Mitte quergehöckert, nach vorne steil abgewölbt und dicht fein gehöckert; hinten fein hautartig genetzt und fein punktiert. Das ganze Halsschild fein lang behaart, die Haare vor der Basis nach vorn gekämmt, der Hinterrand mit einer feinen Reihe gelber, kurzer Haare. Schildchen ganz kurz, breit.

Flügeldecken so breit und mehr als doppelt so lang wie das Halsschild; seitlich parallel bis hinter die Mitte, dann gerundet

und in gerader Linie nach der Naht zu abgeschrägt; an der Naht jede Flügeldeckenspitze für sich abgerundet. Oben in Reihen sehr fein punktiert; Zwischenräume ebenso fein und etwas weitläufiger punktiert; diese Punkte gehen auf dem Absturz in äusserst feine Punktkörnchen über. Vorderrand mit aufstehenden, langen, grauen Haaren besetzt, auf den eigentlichen Decken anliegend behaart.

Länge, 2 Millimeter.

Fundort, Philippinen: LUZON, Provinz Laguna, Mount Maquiling; Sammler *Baker*; 1 Stück in Sammlung Eggers.

XYLEBORUS MELAS sp. nov.

Weib.—Ebenfalls in die *X. cuneatus*-Sippe gehörig, schwarz mit dunkelbraunem Halsschild und helleren Gliedmassen, glänzend, fein behaart.

Kopf fein punktiert.

Halsschild länger als breit, parallelseitig mit geraden Hinterecken, vor der Mitte verschmälert abgerundet; oben nicht merklich gebuckelt, vorne fein gekörnt, hinten fein punktiert, mit glänzender Mittellinie. Schildchen normal, abgerundet.

Flügeldecken so breit und fast doppelt so lang wie das Halsschild, parallelseitig bis hinter die Mitte, dann gerundet verschmälert in eine Spitze auslaufend. Punkte der Reihen ziemlich gross, die Nahtreihe leicht vertieft. Zwischenräume feiner und weitläufiger punktiert und fein hell behaart. Absturz gleichmässig abgewölbt, der Nahtzwischenraum etwas gewölbt und mit feinen Punktkörnchen besetzt.

Länge, 2 Millimeter.

Fundort, Philippinen: LUZON, Provinz Mountain, Balaban: Sammler *Böttcher*; Typen in Sammlung Eggers.

Von *X. cuneolus* sp. nov. durch schmälere, längere Gestalt und im hinteren Teil der Flügeldecken nicht gerade Seiten sofort zu unterscheiden.

XYLEBORUS MINDANAENSIS sp. nov.

Weib.—Lang-cylindrisch, pechbraun, glänzend, dicht gelbbraun behaart. Körperform in allen Einzelheiten wie *X. försteri* Hagedorn.

Stirn fein punktiert, mit erhabener, kurzer Mittellinie. Halsschild gewölbt, länger als breit, mit parallelen Seiten, vorne im Kreisbogen gerundet, mit etwa zehn grösseren, stumpfen Höckern am Vorderrand; dahinter mässig dicht gehöckert, in

der Mitte schwach quer gebuckelt, hinten äusserst fein und dicht punktulierte. Schildchen deutlich.

Flügeldecken in Reihen flach, aber deutlich erkennbar punktiert. Die flachen Zwischenräume über die ganze Fläche äusserst dicht und fein punktulierte und ebenso dicht behaart, einreihig weitläufig von etwas vor der Mitte bis zum Absturz mit kleinen, runden Körnchen besetzt.

Die Form ist etwas schlanker als bei *försteri*, da bei diesem die Flügeldecken in der Mitte etwas ausgebaucht sind, bei *mindanaensis* aber vollkommen parallelseitig.

Länge, 4.2 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Iligan; Sammler *Baker*; 1 Stück in Sammlung Eggers.

XYLEBORUS QUADRATICOLLIS Eggers.

Mann.—Der Mann unterscheidet sich durch etwas hellere, pechbraune Farbe und gedrungene Gestalt; stimmt in den sonstigen Merkmalen mit dem Weib überein. Während bei dem Weib die Flügeldecken etwa 1.5 mal so lang sind wie das Halsschild, ist beim Mann das Verhältnis wie 1.25: 1.

Beim Weib sind die Flügeldecken in der Längsrichtung gleich hinter der Basis nur schwach ansteigend, dann eben bis zum Absturz. Beim Mann ist gleich hinter der Basis eine stärkere Wölbung; infolgedessen fällt bereits das zweite Drittel augenfällig ab, wenn man den Käfer in der Seitenansicht hat.

Die Augen sind etwas schmaler, besonders in der Mitte.

Länge, 3.5 Millimeter.

Fundort, Philippinen: LUZON, Provinz Laguna, Mount Maquiling; 3 Typen; Sammler *Baker* und *Böttcher*; in Sammlung Baker und Eggers.

XYLEBORUS CYLINDRICUS sp. nov.

Weib.—Zu den kleinsten Formen der artenreichen *X. fallax*-Gruppe gehörig, schwarzbraun, glänzend, langgebaut, vollkommen cylindrisch, Hinterrand an der Naht ganz leicht eingebuchtet, spärlich lang behaart.

Kopf matt, spärlich punktiert.

Halsschild über die Hälfte länger als breit, parallelseitig mit geraden Hinterecken, weit vor der Mitte etwas verschmälert und kurz abgerundet; oben eben ohne deutlichen Höcker, vorn fein gehöckert, hinten mikroskopisch fein punktiert.

Flügeldecken so breit und um mehr als die Hälfte länger als Halsschild, vollkommen parallelseitig bis an das Ende, hier kurz gerundet; der Hinterrand nach der Naht zu kaum merklich

eingezogen; fast gerade Punktreihen dicht und kräftig punktiert, Zwischenräume unpunktirt, glatt. Der Eindruck des Absturzes beginnt erst nach dem letzten Drittel, ist ziemlich steil und verbreitert sich stark nach unten, stark glänzend mit nur einer feinen Punktreihe neben der erhöhten Naht. Am Beginn des Absturzes ein kleinerer Zahn auf dem zweiten Zwischenraum, auf dem Rande des vierten ein stärkerer spitzer Zahn, etwas auf den Absturz eingerückt.

Länge, 1.8 bis 2 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Momungan. LUZON, Provinz Mountain, Balbalan; Sammler *Böttcher*; mehrere Stücke in Sammlung Eggers.

XYLEBORUS BALBALANUS sp. nov.

• *Weib.*—Ebenfalls der *X. fallax*-Gruppe angehörig und in Form und Bezeichnung dem *X. cinchonae* nahe verwandt.

Punktierung des Halsschildbasalteiles fein mit schmaler, glatter Mittellinie. Auch die Flügeldecken zeigen nur feine Punkte in den Punktreihen und sehr feine auf den Zwischenräumen. Der Absturz und die Bezeichnung ist wie bei *cinchonae* und *exesus*, nur der Ausschnitt an der Naht ist noch etwas flacher als bei diesen und an beiden Seiten nicht eckig in einen kleinen Zahn vorgezogen, sondern er geht abgerundet in flachem Bogen in den Seitenrand über. Der Absturz zeigt nur eine Reihe kräftiger Punkte vom oberen Zahn im Bogen an dem zweiten Zahn vorbeiführend nach dem Ende des Ausschnittes. Neben der Naht keine Punkte, der ganze Absturz stark glänzend.

Länge, 2.6 Millimeter.

Fundort, Philippinen: LUZON, Provinz Mountain, Balbalan; Sammler *Böttcher*; 1 Type in Sammlung Eggers.

XYLEBORUS AMPHICRANOIDES Hagedorn **LATECAVATUS** var. nov.

Von dem *X. amphicranoides* giebt Hagedorn⁴ eine Abbildung, welche einen Einschnitt am Flügeldeckenende von Dreiviertelkreisform zeigt. Dieser Einschnitt ist stark verzeichnet. Die Type zeigt einen fast hufeisenförmigen Einschnitt mit gerade auslaufenden Seiten und einem aufgebogenen kurzen Enddorn. Ich besitze mehrere mit der Type übereinstimmende Stücke, wie diese von Sumatra stammend, ebenso von Mentawai.

In der Böttcher'schen Ausbeute von den Philippinen finde ich drei abweichende Stücke, bei denen die Enden der Flügeldecken länger ausgezogen sind, sodass der zweite Zahn nicht wie bei

⁴ Ipidae, Wytsmann, Genera insectorum, fasc. III, Tafel 7.

der Type in der Mitte zwischen dem ersten Zahn und dem Enddorn steht, sondern von letzterem weiter entfernt ist. Auch der Einschnitt ist infolgedessen tiefer und zeigt ausserdem eine mehr rechteckige Form, deren innere Ecken allerdings abgestumpft sind. Ausserdem ist die Punktierung der hinteren Halsschildhälfte etwas kräftiger.

Länge, 5 Millimeter.

Ich halte die Form nicht für eine Art, gebe ihr aber einen besonderen Namen, da sie mir von drei Fundorten, Mount Banahao und Los Baños (LUZON) und Subaan (MINDORO) vorliegt. Die typische Form kenne ich von den Philippinen nicht.

XYLEBORUS CYLINDROMORPHUS sp. nov.

Mann und Weib.—Ein kleiner Käfer, der Aehnlichkeit mit *X. defensus* Blandford zeigt, aber einen tiefer ausgehöhlten, scharf gerandeten Absturz hat; braun, mässig glänzend, einzeln lang behaart.

Weib.—Kopf nicht erkennbar, weil in das Halsschild zurückgezogen.

Halsschild flach gewölbt, um drei Viertel länger als breit mit parallelen Seiten und ausgeprägter Seitenkante, vorne wenig verschmälert und abgerundet; oben flach ohne Buckel. Im vorderen Drittel mit flachen, schuppenartigen Runzeln bedeckt, in den übrigen zwei Dritteln fein punktiert, vor dem Schildchen eine feine, flach eingedrückte Längslinie. Schildchen deutlich, dreieckig.

Flügeldecken an der Basis so breit und über die Hälfte länger als Halsschild mit geraden, nach hinten auseinandergehenden Seiten, die Fläche neben der Naht etwas abgeflacht. Punkt-reihen sehr fein punktulierte, die ebenen Zwischenräume tragen weitläufig einige Punktkörnchen mit langen Haaren. Absturz beginnt nach dem zweiten Drittel, ist tief ausgehöhlt, mit leicht erhabener Naht, stark glänzend ohne Punktierung. Der Rand des Absturzes ist scharf ausgezogen vom ersten Zahn bis zu einem flachen Ausschnitt unten an der Naht. Der erste kurze Zahn steht auf dem Rande des zweiten Zwischenraumes, von da bis zur Naht ist der Absturz einfach abgewölbt, auf dem scharfen Seitenrand steht ausser einigen langen Haaren etwas über der Mitte der zweite, lange, etwas flachgedrückte Zahn. Den flachen Ausschnitt am Hinterrand begrenzt ein feiner Höcker.

Mann.—Kleiner, mit kürzerem, nach vorn verschmälerten Halsschild und auch kürzeren Flügeldecken; vor und hinter dem

zweiten Zahn trägt der Seitenrand einen deutlichen Höcker und am Beginn des Ausschnittes am Hinterrand einen deutlichen Zahn.

Länge: Weib, 2 Millimeter; Mann, 1.5 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Surigao, Surigao; Sammler Böttcher; Mann und Weib in Sammlung Eggers.

XYLEBORUS BORNEENSIS sp. nov.

Gehört in die nächste Verwandtschaft von *X. dolosus* Blandford. Dunkelbraun, glänzend, spärlich behaart.

Kopf mit breiter Stirn, fein punktiert. Augen von vorne fast zur Hälfte sichtbar.

Halsschild kaum 1.5 mal so lang wie breit, bis vor die Mitte parallelseitig, mit leicht abgestumpften Hinterecken, vorne leicht verschmälert und abgerundet. Skulptur wie bei *X. dolosus*.

Flügeldecken 1.5 mal so lang und ebenso breit wie Halsschild, parallelseitig mit der gleichen flachen Einbuchtung am Hinterrande wie bei *X. dolosus*. Auch die Punktierung der Reihen ist deutlich, die der Zwischenräume sehr fein. Absturz etwas tiefer ausgehöhlt als bei *dolosus*. Bei diesem stehen die beiden kräftigen Zähne auf dem zweiten Zwischenraum, bei *borneensis* der untere stärkste auf dem dritten Zwischenraum etwa in der Mitte der Absturzlänge, der zweite Zwischenraum trägt vor dem Hinterrande einen scharfen Zahn, der bei *dolosus* und *persimilis* kaum angedeutet ist. Die seitlichen den Absturz begrenzenden Zähne schwach. Punktierung des Absturzes deutlich, nicht verworren wie bei den anderen beiden Arten.

Länge, 2.8 bis 2.9 Millimeter.

Fundort, BORNEO, je 1 Type von Sandakan und Sarawak, in Sammlung Eggers.

XYLEBORUS PERSIMILIS sp. nov.

Mann und Weib.—Dem *Xyleborus dolosus* Blandford, von dem ich ein Exemplar, durch Sampson mit der Type verglichen, besitze, sehr ähnlich, aber länger, schmaler und feiner punktiert.

Weib.—Zierlich, lang gestreckt, glänzend, dunkelbraun, spärlich behaart.

Stirn seitlich stark punktiert, in der Mitte ein unpunktierter Fleck, einzeln lang behaart.

Halsschild mindestens 1.5 mal so lang als breit, bis weit vor die Mitte parallelseitig, zur Basis nicht verschmälert, Hinterecken kaum abgestumpft; Vorderrand ohne vorherige Verschmälerung breit gerundet. Oben flach gewölbt ohne Höcker.

Vorn sehr fein gehöckert, hinten feiner punktiert als bei *dolosus* mit schmaler, unpunktierter Mittellinie.

Flügeldecken gleichbreit wie Halsschild und fast 1.75 mal so lang wie dieses, vollkommen parallelseitig bis an das Ende, hier einzeln abgerundet mit gemeinsamer Einbuchtung wie bei *dolosus*. Absturz beginnt erst hinter der Mitte und ist länger als bei *dolosus*. Punktreihen und Zwischenräume gleichmässig fein punktiert (bei *dolosus* Punktreihen stärker). Auf dem Absturz eine flache Furche neben der Naht, die Punkte sind hier undeutlich. Bezeichnung wie bei *dolosus*, jedoch kräftiger als bei meinem Exemplar. Die zweite Zähnnchenreihe ist etwas ausgebogen und tritt nahe an die kleinen Randhöcker des Absturzes heran; die erste Zähnnchenreihe auf dem zweiten Zwischenraum.

Mann.—Kleiner, etwas kürzer im Verhältnis zur Breite. Augen schmaler; Halsschild äusserst fein punktuliert ohne Höcker im Vorderteil. Absturz wie beim Weib bewaffnet.

Länge: Mann, 1.6 Millimeter; Weib, 2.4 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Surigao, Surigao, darunter 1 Mann. LUZON, Provinz Mountain, Balbalan; Sammler Böttcher; Typen in Sammlung Eggers.

XYLEBORUS LUGUBRIS (Eichhoff i. l.) sp. nov.

Weib.—Der Körperform nach dem *X. destruens* Blandford ähnlich, aber wohl nicht näher verwandt, da dieser gerade Auslenkante der Vorderschienen mit wenigen Zähnen besitzt.

Lang cylindrisch, pechschwarz mit pechbraunem Halsschildvorderrand und Gliedmassen, wenig behaart, von mässigem Glanze.

Kopf leicht gewölbt, fein punktiert.

Halsschild kaum länger als breit, hinten fast parallelseitig, mit geraden Hinterecken, nach vorne leicht erweitert und von der Mitte an in kräftigem Halbkreis abgerundet. In der Mitte leicht quergebuckelt, vorn dicht gehöckert, hinten dicht runzelig punktiert.

Flügeldecken so breit und 1.75 mal so lang wie das Halsschild, parallelseitig, nach hinten ganz leicht erweitert und breit abgerundet; Hinterrand deutlich, aber nicht scharf ausgeprägt. Punktreihen dicht, aber nicht vertieft, mit deutlichen Punkten besetzt, Zwischenräume mit feineren, aber auch sehr deutlichen Punkten und ganz feinen Körnchen besetzt, der zweite, vierte, und fünfte unregelmässig zweireihig, die anderen einreihig. Das verschimmelt gewesene Stück zeigt Spuren von ziemlich

langer, heller Behaarung. Absturz an beiden Seiten neben der gewölbten, erhöhten Naht in der unteren Hälfte breit eingedrückt. Vorderschienen aussen gleichmässig gebogen und an der ganzen Kante dicht mit Zähnchen besetzt.

Länge, 3 Millimeter.

Fundort, Philippinen. Type in Sammlung Eichhoff.

XYLEBORUS OBLIQUESECTUS sp. nov.

Weib.—Gehört in die Verwandtschaft des *X. major* Sampson und *irregularis* mihi. Dunkelbraun mit cylindrischem Halsschild und nach hinten verbreiterten Flügeldecken mit schrägem, an der Naht erhabenen Absturz.

Kopf ist bei dem Einzelstück nicht zu erkennen, da er unter das Halsschild eingezogen ist.

•Halsschild parallelseitig mit geraden Hinterecken und vorne halbkreisförmig gerundet mit in vier wenig ausgebildete, flache Höcker vorgezogener Mitte, so lang wie breit, ohne deutlichen Buckel, vorne dicht aber nicht kräftig gehöckert, hinten glänzend, dicht punktiert.

Flügeldecken doppelt so lang und an der Basis ebenso breit wie Halsschild, nach hinten stark verbreitert bis zum Absturz; von der Mitte des Absturzes sind die Seiten schräg nach der Naht zugestutzt und an der Naht abgerundet. Punktreihen und Zwischenräume gleich kräftig punktiert, Punkte unregelmässig gestellt, sodass Reihen und Zwischenräume nicht zu unterscheiden sind. Bis zum Absturz sind die Flügeldecken unbehaart, glänzend. Absturz beginnt in der Mitte und fällt schräg nach der Spitze ab, ist an der Naht leicht dachförmig erhöht und etwas gewölbt. Absturz in Reihen deutlich punktiert; Zwischenräume leicht gerunzelt und einreihig mit deutlichen Höckern ziemlich dicht besetzt, welche lange Haare tragen. Absturzrand rundum deutlich, aber nicht scharf gekantet.

Länge, 4.5 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Kolambugan; Type in Sammlung Eggers.

XYLEBORUS SUBLONGUS sp. nov.

Weib.—Mit *Xyleborus major* Sampson verwandt, aber schmaler. Dunkelbraun, glänzend, lang, fast cylindrisch, nach hinten leicht erweitert, lang behaart.

Kopf glänzend, mit glatter Mitte über dem Munde, sonst kräftig punktiert, lang behaart.

Halsschild wenig länger als breit, parallelseitig, ohne Buckel, vorne halbkreisförmig gerundet, ohne Höcker am Vorderrande.

Vorne dicht, fein gekörnt und gehöckert, hinten glänzend mit feinen Punkten.

Flügeldecken an der Basis so breit und im Ganzen mehr als doppelt so lang als Halsschild, mit geraden Seiten, nach hinten leicht erweitert, erst im letzten Fünftel nach der Naht zu abgeschrägt, an der Naht gerundet. In nicht vertieften Reihen mässig stark punktiert, die erste Reihe etwas stärker als die anderen; Zwischenräume kaum feiner, aber etwas weitläufiger punktiert. Absturz hinter der Mitte allmählig abgewölbt, ohne Bruch oder Kante am oberen Rande. Naht auf dem Absturz etwas dachförmig erhaben. Die Punktreihen verlöschen auf dem Absturz allmählich, die Zwischenräume tragen von der Mitte der Flügeldecken an eine dicht gestellte Reihe kräftiger Körner, die sehr lang behaart sind und von denen die Zweite und dritte Reihe im leichten Bogen erst auswärts und dann nach der Nahtspitze zu gerichtet sind.

Länge, 3.5 Millimeter.

Fundort, Philippinen: LUZON, Provinz Mountain, Balbalan, 1 Type, in Sammlung Eggers; ein zweites Stück von Provinz Bataan, Limay, auf derselben Insel in Sammlung Linnaniemi, Turku, Finnland; beide von *Böttcher* gesammelt.

XYLEBORUS PILOSULUS sp. nov.

Weib.—Rotbraun mit dunkelbraunen Flügeldecken, cylindrisch, mit ganz gerandetem Absturz, mattglänzend mit feiner dichter Behaarung, mit *X. obtusus* mihi nahe verwandt, aber schlanker.

Kopf zwischen den Augen glänzend, tief punktiert, über den Augen matt, hautartig genetzt und sehr fein punktiert.

Halsschild kaum länger als breit, seitlich parallel, vorne im Kreisbogen gerundet, ohne Abzeichen am Vorderrand. Die vordere Hälfte sehr klein gehöckert, hinten äusserst fein punktiert.

Flügeldecken so breit und 1.75 mal so lang als das Halsschild, äusserst fein unregelmässig punktiert, ohne dass Punktreihen zu erkennen sind. Absturz rundum deutlich, aber nicht scharfkantig gerandet, ziemlich steil abfallend, in der Fläche leicht gewölbt, die Naht in der unteren Hälfte breit aufliegend. Die ganze Fläche mit feinen Körnchen unregelmässig dicht überstreut. Auf dem Aussenrande des erhöhten Nahtzwischenraumes stehen eine Anzahl stärkere Höcker.

Länge, 3.5 Millimeter.

Fundort, Philippinen: LUZON, Provinz Laguna, Mount Maquiling, 1 Type in Sammlung Eggers; Cotypen aus Baguio von

derselben Insel in Sammlung des Bureau of Science, Manila, und Sammlung Eggers.

XYLEBORUS SIMILIS sp. nov.

Weib.—Gehört in die Nähe von *X. insulindicus* mihi und *batoensis* mihi. Rotbraun, mit dunkleren Flügeldecken, kahl bis auf wenige lange Haare, mässig glänzend.

Kopf runzelig, hautartig genetzt, matt mit kräftigen Punkten und einer erhabenen Längslinie über dem Munde; lang behaart; Augen ausgerandet.

Halsschild kugelig gewölbt, kaum länger als breit, mit geraden Hinterecken, leicht ausgebogenen Seiten; vorne halbkreisförmig gerundet mit kurzer, vorgezogener Schnauze am Vorderrand. Höckerfleck besteht aus niedrigen, breiten Höckern, welche, nach hinten kleiner werdend, weit über die Mitte des Halsschildes hinaus gehen. Das letzte Drittel des Halsschildes dicht und tief punktiert; das ganze Halsschild fast matt, Schildchen klein, aber deutlich.

Flügeldecken so breit und 1.75 mal so lang wie Halsschild, mit fast parallelen Seiten. Eben hinter der Mitte beginnt der schräg geschnittene Absturz, dessen obere und Seitenränder deutlich gebrochen, aber nicht scharfkantig sind, nur der Hinterrand ist schärfer. Scheibe in vertieften Streifen grob punktiert, die erhöhten Zwischenräume nur wenig schwächer punktiert. Der Nahtzwischenraum, in der ersten Hälfte einreihig, verbreitert sich direkt vor dem Absturz und ist hier beulig aufgetrieben und mehrreihig unregelmässig punktiert, der zweite schmal und einreihig, der dritte vorn und am Ende unregelmässig doppelt, in der schmalen Mitte einreihig punktiert, die nächsten beiden breit und mehrreihig punktiert. Der Absturz ist flach, gegen das Ende breit eingedrückt, gleichmässig flach und runzelig über die ganze Fläche punktiert.

Länge, 4.5 bis 5 Millimeter.

Fundort, Philippinen und zwar San Teodoro, MINDORO, Sammler Böttcher, und Mount Maquiling, LUZON, Sammler Baker, je eine Type in Sammlung Eggers und Baker.

XYLEBORUS EXSCULPTUS sp. nov.

Weib.—Ein gedrungener, cylindrischer Käfer, zwischen *X. artestriatus* Eichhoff und *X. amanicus* Hagedorn einzureihen. Braun, glänzend, ziemlich dicht und lang behaart.

Kopf breit, flach gewölbt, matt, äusserst fein punktiert, lang behaart.

Halsschild kaum länger als breit, fast parallelseitig, nach vorn verbreitert und sehr kurz und breit vorn abgerundet. Stark gewölbt, in der Mitte leicht Quergebuckelt, vorne dicht und fein gehöckert, hinten äusserst fein punktiert.

Flügeldecken so breit und 1.75 mal so lang wie Halsschild, parallelseitig, hinten kräftig gerundet. Basis lang und dicht behaart. Punktreihen deutlich, nicht sehr dicht punktiert, auch Zwischenräume wenig schwächer und weitläufiger punktiert und lang behaart. Absturz breit bis zum dritten Zwischenraum eingedrückt, auch Naht nicht erhaben. Der stark hervortretende Rand des Absturzes im Bogen mit sieben oder acht deutlichen, kurzen, dunklen Zähnchen besetzt. Eindruck des Absturzes ziemlich dicht punktiert.

Länge, 2 bis 2.2 Millimeter.

Fundort, Philippinen: LUZON, Provinz Bataan, Limay. MINDANAO, Provinz Lanao, Kolambugan: Provinz Surigao, Surigao. Sammler G. Böttcher; Typen in Sammlung Eggers.

XYLEBORUS SEXSPINOSUS Motschulsky.

Mann.—Von ähnlicher Form, wie der von mir beschriebene⁵ und abgebildete Mann des nahe verwandten *X. gracilipes* Eichhoff. Pechbraun, glänzend, einzeln lang behaart.

Kopf ganz unter dem lang vorgezogenen Halsschild verdeckt.

Halsschild klobig im Verhältnis zu den kurzen Flügeldecken, doppelt so lang wie diese. Hinterecken abgerundet, Seiten in der hinteren Hälfte fast parallel, im dritten Viertel leicht verschmälert bis zu einem vorspringenden, kräftigen Randhöcker, dann im Bogen von beiden Seiten eingeschnitten und in eine ziemlich breite, vorn abgestutzte Schnauze vorgezogen. Hintere Hälfte stark gewölbt, schwach gerunzelt und äusserst fein punktiert; in der Mitte beginnt beim ersten Viertel ein breiter, tief nach vorn abfallender Einschnitt, dessen Seitenkanten dick und etwas abgerundet sind. Die Seitenflächen dieses Einschnittes sind dicht und fein gekörnt, und sehr fein und kurz behaart. In der Seitenansicht ist der Beginn des Absturzes stark gewölbt, aber ohne den Höcker des *X. gracilipes*; fällt dann ziemlich steil ab bis zu dem bereits erwähnten, unter der Mitte vorgezogenen kräftigen Höcker, dann folgt die abgeplattete, etwa ein Viertel der Länge einnehmende Schnauze. Im Grunde der vertieften vorderen Hälfte liegt ein ovales deutlich eingedrücktes Feld,

⁵Zool. Med. (1922) 192.

schmäler und etwas kleiner als bei *gracilipes*, stark glänzend und fein punktiert.

Flügeldecken schmäler als Halsschild und hinter der Mitte stark verschmälert abgerundet. Oben steil abgewölbt und an der Naht breit eingedrückt; auf dem Absturz zeigt der flache Eindruck fast eine rhombische Form ohne scharfe Ränder. Unregelmässig, ziemlich grob punktiert, Absturz ohne Andeutung von Zähnen.

Länge, 2.8 Millimeter.

Fundort der Type, Philippinen: LUZON, Provinz Camarines Sur, Mount Isarog, 1 Mann und mehrere Weiber aus der Ausbeute Böttcher's in Sammlung Eggers. Zwei weitere Männer sah ich in der Sammlung C. F. C. Beeson, Dehra Dun (N. P., India).

XYLEBORUS ERINACEUS sp. nov.

Weib.—Eine eigenartige Form, gelbbraun, mässig glänzend, kurz cylindrisch, mit schrägem, matten, dunkelbraunen Absturz voll langer Stacheln und Haare.

Kopf fein genetzt mit feinen Punkten.

Halsschild wenig länger als breit, in der hinteren Hälfte mit parallelen Seiten und geraden Hinterecken, vorne verschmälert abgerundet. In der Mitte leicht quergebuckelt, vorne fein gehöckert, hinten sehr fein punktiert.

Flügeldecken so breit und um die Hälfte länger als Halsschild, nach hinten etwas breiter werdend und kurz abgerundet. Oben im Basalteil und an den Seiten glänzend und gleichmässig sehr fein und dicht punktuiliert, ohne dass Punktreihen zu erkennen sind. Absturz beginnt eben vor der Mitte und ist platt abgeschrägt, ohne scharfen Rand. Neben der Naht ein flacher Eindruck. Die ganze Fläche des Absturzes ist matt ohne erkennbare Punkte oder Reihen und ziemlich unregelmässig mit kurzen und langen Dornen und besonders im unteren Teil mit langen Haaren besetzt. An der Naht stehen nur im unteren Teil vier verschieden lange Dornen, in einer zweiten unregelmässigen Reihe vier, von denen zwei sehr lange, dann folgen in der nächsten Reihe noch zwei starke Zähne und am unteren Rand drei oder vier ebensolche. Oben und am Seitenrand stehen eine Anzahl kleinerer Zähne und spitzer Körnchen. Vorderschienen mit fünf starken Zähnen am Aussenrand.

Länge, 2.2 Millimeter.

Fundort, Philippinen: Mindanao, Provinz Lanao, Kolambugan; Sammler *Böttcher*; 1 type in Sammlung Eggers.

WEBBIA SUBLAEVIS sp. nov.

Weib.—Hellbraun mit dunkelbraunem Halsschildhöckerfleck, glänzend, fein behaart, hinten sehr kurz verschmälert.

Kopf dicht und gross punktiert.

Halsschild länger als breit, viereckig, mit leicht abgerundeten Hinterecken, durch Höcker verstärkte scharfe Vorderecken, deutlich ausgeprägte Seitenkante. Vorderrand ist gerade abgestutzt, ein breiter, hellbrauner, kahler Streifen dahinter hebt sich vor dem gehöckerten, dunklen Teil auffällig ab, Vorderrand unbewehrt. Oben dicht vor der Mitte kaum merklich gebuckelt, hinten matt und unpunktirt. Schildchen verhältnismässig gross.

Flügeldecken fast doppelt so lang und ebenso breit wie Halsschild, glänzend, äusserst fein punktiert, Zwischenräume ebenso fein und dicht punktiert. Seiten bis hinter die Mitte parallel, dann kurz abgerundet verengt und nach der Naht stumpf zugeschrägt. Absturz ebenso kurz abgewölbt, hier matt, dicht in vertieften Reihen gestreift punktiert, Zwischenräume fein gekantet und dicht mikroskopisch fein gekörnt und fein abstehend behaart. Der zweite Zwischenraum läuft in ein feines Zähnchen aus.

Länge, 2.2 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Surigao, Surigao; Sammler *Böttcher*; Type in Sammlung Eggers.

WEBBIA MEDIUS sp. nov.

Klein, cylindrisch, mässig glänzend, auf den Flügeldecken gestreift und einreihig fein behaart, pechbraun mit gelbbraunen Gliedmassen.

Kopf breit gewölbt, ohne Eindruck über den Mundteilen, fein hautartig genetzt, zerstreut und fein punktiert, mit sehr feiner Mittellinie über die ganze Stirn.

Halsschild 1.5 mal so lang wie breit, parallelseitig, vorn im letzten Drittel leicht verschmälert und abgerundet. Oben ohne deutlichen Buckel; vordere Hälfte fein und dicht gehöckert, hintere fast matt, hautartig genetzt, ohne deutliche Punkte.

Flügeldecken ebenso breit und wenig länger als das Halsschild; parallelseitig bis zum letzten Viertel, dann stark verschmälert abgerundet. Oben eben bis zum letzten Viertel, dann steil abgewölbt ohne angedeutete Kante. Das vordere Drittel glänzend,

die andern zwei Drittel matt. Von den Punktreihen beginnt nur die erste direkt am Schildchen, die andern erst nach ein Fünftel der Flügeldeckenlänge, vertiefen und verbreitern sich bis zum Absturz. Zwischenräume im vorderen Teil breit und wie der Basalteil punktiert, in den matten, hinteren zwei Dritteln schmal und erhaben, dicht und fein gekörnt und mit einer dichten Reihe heller, kurzer Haare besetzt.

Länge, 1.5 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Kolambugan. MINDORO, Subaan. NEGROS, Provinz Occidental Negros, Fabrica. Typen in Sammlung Eggers und Bureau of Science, Manila; 1 Stück in Sammlung Eggers auch von Süd Sumatra.

WEBBIA IMITATOR sp. nov.

• Gedrungener als *W. medius*, mit dichterem und längerer Behaarung und kleinerem, glänzenden Basalteil der Flügeldecken. Pechbraun, grossenteils matt, mit wenig helleren Gliedmassen.

Kopf breit, flach gewölbt, matt, fein genetzt und sehr fein punktiert mit kleinem, glänzenden Fleckchen im oberen Teil der Stirn.

Halsschild gut ein Drittel länger als breit, parallelseitig bis vor die Mitte, dann verschmälert abgerundet, Hinterecken abgestumpft. Vorderes Drittel fein gehöckert, hintere zwei Drittel mattglänzend und sehr fein punktuliert.

Flügeldecken so breit und um $\frac{1}{4}$ länger als Halsschild, parallelseitig bis zu drei Viertel der Länge, dann stark verschmälert abgerundet. Oben an der Basis, bis zur Schulterbeule ein schmales, glänzendes, unregelmässig punktiertes Feld, in dem keine Punktreihen erkennbar sind. Der übrige Teil der Flügeldecken matt, Punktreihen tief und breit gerieft, Zwischenräume daher erhaben und vorn mehrreihig, hinten auf dem Absturz einreihig sehr fein granuliert und ebenso vorn unregelmässig, hinten einreihig dicht und ziemlich lang behaart.

Länge, 1.7 Millimeter.

Fundort, Philippinen: Masbate, Aroroy; Type in Sammlung Eggers.

WEBBIA PLATYPOIDES sp. nov.

Von der gleichen absonderlichen Form wie *W. pabo* Sampson. Pechbraun, Hinterleib und die vorderen zwei Drittel der Flügeldecken blassgelb, der mit Auswüchsen versehene Absturz wieder dunkelbraun, Skulptur sehr fein, Behaarung kaum sichtbar.

Kopf gewölbt, mattglänzend, fein hautartig genetzt, mit zerstreuter, feiner Punktierung und einer schmalen Bürste längerer Haare über den Mundteilen.

Halsschild 1.75 mal so lang als breit, leicht abgerundet; Hinterecken vollkommen parallelseitig bis zum breit abgerundeten, in der Mitte abgestutzten Vorderrand. Basis an beiden Seiten leicht geschwungen. Oben ganz flach ohne Andeutung eines Buckels. Erstes Drittel fein und dicht gekörnt, hintere zwei Drittel matt, äusserst fein punktuert.

Flügeldecken ebenso breit und bis zur Oberkante des Absturzes kaum länger als das Halsschild, vollkommen parallelseitig. Am Hinterrand jeder Flügeldecke ein kräftiger langer Dorn durch einen hufeisenförmigen Einschnitt an der Naht von dem andern getrennt. Die ersten zwei Drittel bis zum Absturz mit kaum sichtbar feinen Punktreihen, Pünktchen auf den Zwischenräumen sind selbst mit guter Lupe kaum erkennbar. Oberseite glänzend, unbehaart. Der Absturz scharf und mit feinen, dunkelbraunen Zähnen besetzt, von denen die ersten drei je auf dem Ende des entsprechenden Zwischenraumes sitzen, die seitlichen stehen viel dichter. Kurz vor dem Uebergang des Seitenrandes in den Enddorn ist ersterer etwas ausgebogen. Der Absturz ist glänzend mit deutlichen Punktreihen, bei zwei Drittel seiner Länge in der Mitte aufgetrieben. Auf dieser Erhöhung sitzt, nicht wie bei *W. pabo* in der Mitte zwischen Naht und Seitenrand, sondern nahe der Naht, ein merkwürdiger Auswuchs etwa von der Form der Schwanzflosse eines Hai-fisches, dessen oberes längeres Ende etwas nach hinten und innen gebogen ist; das kürzere untere steht schräg nach seitwärts.

Länge, einschliesslich Enddorn, 2.4 Millimeter.

Fundort, Philippinen: BASILAN. MINDANAO, Provinz Lanao, Kolambugan: Provinz Zamboanga, Port Banga; Sammler Böttcher; Typen in Sammlung Eggers.

WEBBIA CONFINIS sp. nov.

Ist mit *W. canaliculatus* mihi von Neu Guinea fast gleich. Körperform erscheint wenig schlanker, weil die Flügeldecken vor dem Absturz nicht so stark gewölbt sind. Hauptunterschied liegt im Basalteil der Flügeldecken, der bei *canaliculatus* glänzend ist und nicht von den vertieften punktlosen Streifen durchsetzt ist. Bei *confinis* gehen die Streifen durch bis zur Basis, allerdings flacher werdend. Die Zwischenräume sind im Basalteil breit, flach, und glänzend, besonders die drei ersten. Während sich bei jenem das glänzende, unregelmässig punktierte

Feld an der Seite bis zur Mitte hinauszieht, gehen hier gerade die vertieften Streifen durch bis zur Basis und an der Seite ist nur noch eine schmale Schulterbeule glänzend. Die erhöhten Kiele sind bei *W. canaliculatus* von ihrem Beginn bis zum Anfang des Absturzes etwas nach aussen gebogen, bei *confinis* dagegen der Naht parallel. Basalteil des Halsschildes im Mittelfeld viel kräftiger punktiert.

Länge, 1.6 Millimeter.

Fundort der Einzeltype Philippinen: MINDANAO, Provinz Lanao, Kolambugan; Sammler *Böttcher*; in meiner Sammlung.

WEBBIA MUCRONATUS sp. nov.

Grösser als die andern mir bekannten Arten, kahl, mattglänzend, pechbraun mit hellgelbem Mittelstück der Flügeldecken, Gliedmassen, und Hinterleib; Absturz rundum mit scharfen Zähnen besetzt.

Kopf fein genarbt, über dem Munde runzelig mit zerstreuten Punkten und kurzem, erhabenen Längskiel.

Halsschild um ein Viertel länger als breit mit parallelen Seiten, geraden Hinterecken, gerade abgestutztem Vorderrand und sehr stumpf abgerundeten Vorderecken; das Halsschild sieht daher fast rechteckig aus. Vorne steil abfallend und sehr fein gehöckert, nur hinter dem Vorderrand eine unregelmässige Reihe stärkerer Höcker; die andern zwei Drittel des Halsschildes hautartig genetzt und äusserst fein und dicht punktiert.

Flügeldecken so breit und um die Hälfte länger als das Halsschild, äusserst fein ohne Unterschied von Reihen und Zwischenräumen punktiert. Die pechbraune Farbe der Basis geht allmählich ohne scharfe Grenze ins hellgelbe über, während oben vor dem scharf abfallenden Absturze wieder scharf die pechbraune Farbe beginnt. In diesem braunen Streifen die Reihen tief eingeschnitten, die Zwischenräume stark gewölbt und in einen den Absturz überragenden scharfen und langen Zahn ausgezogen. Diese achtundzwanzig scharfen Zähne umgeben den ganzen Rand und werden nach dem Hinterrande hin schwächer. Absturz matt, der etwas erhabene Nahtzwischenraum mit einer dicht gedrängten Reihe von Querhöckern besetzt, drei weitere Reihen sind mit kleineren Höckern weitläufiger besetzt.

Länge, 3.3 Millimeter.

Fundort, Philippinen: MINDANAO, Provinz Lanao, Kolambugan; Sammler *Böttcher*; 1 Type in Sammlung Eggers.

WEBBIA DENTATUS sp. nov.

In Form und Grösse dem *W. mucronatus* sp. nov. sehr ähnlich, jedoch ganz braun, Flügeldecken ein wenig kürzer.

Der Hauptunterschied liegt in der Form des Absturzes. Eben vor demselben sind die Flügeldecken bis zur Mitte des Seitenrandes herunter rundherum eingedrückt, rauh und matt, die Riefen nicht so tief eingedrückt, die zwanzig Zähne sind stumpf und überragen den Rand kaum. Ausser der dichtgedrängten Höckerreihe auf dem erhabenen Nahtzwischenraum nur zwei deutliche Reihen kräftiger Körner auf dem Absturz.

Länge, 3 Millimeter.

Fundort, Philippinen: NEGROS, Cuernos Mountains; Sammler *Baker*; 1 Type in Sammlung Eggers.

WEBBIA PUSILLUS sp. nov.

Ein kleiner, cylindrisch gebauter Käfer, dessen Halsschild vorne nicht breit abgestutzt ist, wie bei den grösseren Arten. Mattglänzend, mit mattem Absturz, pechbraun mit heller braunem Basalteil des Halsschildes, ebensolchen Gliedmassen und Hinterleib und braunrotem, schräg geschnittenen Absturz.

Kopf flach gewölbt, matt, mit sehr feinen Punkten.

Halsschild $\frac{1}{3}$ länger als breit, mit abgestutzten Hinterecken, bis vor die Mitte parallelen Seiten, im vorderen Drittel verschmälert abgerundet. Oben eben, ohne Buckel nach vorne abgewölbt, in der vorderen Hälfte fein gehöckert, hinten mattglänzend mit sehr feinen Pünktchen.

Flügeldecken 1.5 mal so lang und ebenso breit wie das Halsschild, vollkommen parallelseitig und cylindrisch bis zum sehr breiten, schräg geschnittenen Absturz; bis kurz vor dem Absturz mässig glänzend mit feinen Punkten, die undeutlich gereiht sind. Zwischenräume kaum sichtbar fein und spärlich punktulierte mit sehr feinen Härchen. Kurz vor dem Absturz, der oben ohne scharfe Kante steil abgewölbt ist, sind die Flügeldecken matt, dicht und sehr fein regellos punktulierte, und tragen eine dichte Reihe sehr feiner Körnchen, die oben auf dem Absturz wieder verschwinden; sie tragen eine Reihe deutlicher Härchen, die bis zum Hinterrand durchgehen. Seiten- und Hinterrand schärfer ausgeprägt und fein und dicht gezähnt.

Länge, 1.2 Millimeter.

Fundort, Philippinen: LUZON, Provinz Mountain, Balbalan; Sammler *Böttcher*; Typen in Sammlung Eggers.

NEW PHILIPPINE MEMBRACIDÆ (HOMOPTERA)

By W. D. FUNKHOUSER

Of the University of Kentucky, Lexington

FOUR PLATES

From a considerable amount of Philippine material studied by me during the past three years, most of which was obtained through the courtesy of Mr. R. C. McGregor, of the Philippine Bureau of Science, the following new species belonging to the family Membracidæ can be described:

PYRGONOTA BULBITURRIS sp. nov. Plate 1, figs. 1 and 2.

Distinguished by the large subspherical bulb on the top of the pronotal process. Dark brown, punctate, pubescent; bulb reticulate; posterior process decurved, extending beyond internal angles of tegmina; tegmina brown with a hyaline spot at internal angles; legs yellow.

Head foliaceous, longer than broad, black, finely punctuate, sparingly pubescent; base arcuate; eyes small, black; ocelli small, pearly, twice as far from each other as from the eyes and situated about on a line drawn through centers of eyes; clypeus flattened, longer than broad, continuing inferior margin of cheeks.

Pronotum dark brown, coarsely punctate, finely pubescent; pronotal horn broad as seen from the side, flattened laterally, sides ridged, bearing at the top a large subspherical bulb, this bulb broader and longer than high, reticulate, produced behind into four short blunt spines, two close together on either side of median line, the other two at caudolateral margins; median carina percurrent over bulb; posterior process heavy, decurved, sharply singly carinate, tectiform, upper margin very finely toothed, apex acute, extending beyond internal angles of tegmina; tegmina long, narrow, pointed, brown, basal half punctate, veins indistinct.

Sides of thorax brown, tomentose; abdomen brown; legs yellow.

Length from front of head to tips of tegmina, 7 millimeters; maximum width across bulb between tips of lateral spines, 5.5.

Type, male.

Locality, Kavignian, Luzon.

Described from a single specimen, received from Staudinger and A. Bang-Haas, now in my collection.

PYRGONOTA BINODIS sp. nov. Plate 1, figs. 3 and 4.

Distinguished by the double node on the top of the long slender pronotal process. Large, brown, punctate, not pubescent; posterior process simple, slender, unicarinate, reaching just to internal angles of tegmina; legs flavous.

Head foliaceous, longer than wide, brown, roughly sculptured, finely punctate, not pubescent; base sinuate; eyes large, brown; ocelli yellow, farther from each other than from the eyes and situated slightly above a line drawn through centers of eyes; clypeus trilobate, continuing the inferior margins of the cheeks.

Pronotum uniformly brown, coarsely punctate, not pubescent; pronotal process long, slender, sides ridged, rising vertically above the head, slightly curved backward, the tip expanded into an ovoid swelling, this swelling reticulate, compressed in middle to form two nodes, the lower subspherical, the upper bearing on each side a sharp tooth; posterior process slender, slightly sinuate, tectiform, unicarinate, tip slightly depressed and just reaching the internal angles of tegmina.

Tegmina long, narrow, pointed, vinaceous, translucent; veins indistinct; base opaque and punctate.

Sides of thorax brown and somewhat tomentose; undersurface and abdomen light brown; legs flavous; tibiae flattened and pilose.

Length from front of head to tips of tegmina, 8 millimeters; height of pronotal horn from base of head, 12.

Type, male.

Localities, type, Mount Banahao, Luzon; paratype, Isabela, San Mariano.

Described from two specimens, both males. Type received from Staudinger and A. Bang-Haas and now in my collection; paratype in Philippine Bureau of Science collection. The paratype is much darker than the type and the upper node of the pronotal process is slightly mutilated. It was collected February 15, 1926, by Mr. R. C. McGregor.

PYRGONOTA BREVIFURCA sp. nov. Plate 2, figs. 5 and 6.

Large, brown, rugose, punctate, pubescent; pronotal horn long, uneven, ridged, bearing at the tip two very short prongs; posterior process long, slender, unicarinate, decurved, reaching

just beyond internal angles of tegmina; tegmina brown, opaque, wrinkled, pilose, basal half punctate; undersurface and legs brown.

Head triangular, longer than broad, brown, punctate, pilose, roughly sculptured; base arcuate; eyes large, brown; ocelli large, vitreous, farther from each other than from the eyes and situated slightly above a line drawn through centers of eyes; clypeus longer than wide, trilobed, extending for more than half its length below inferior margins of cheeks and continuing the approximate outline of these margins.

Pronotum brown, coarsely punctate, pilose with grayish hairs, rough, ridged, reticulate; pronotal process long, crooked, carinate, reticulate, extending upward and forward, bearing at the tip two very short diverging prongs; posterior process long, slender, decurved, unicarinate, punctate, pilose, tip darker and extending just beyond internal angles of tegmina.

Tegmina long, narrow, pointed, brown, opaque, wrinkled, pilose, basal half punctate, veins heavy and prominent.

Sides of thorax brown and tomentose; abdomen brown; legs lighter brown; tibiae very little flattened.

Length from front of head to tips of tegmina, 9 millimeters; height of pronotal process above head, 11.

Type, female.

Locality, Baguio, Benguet Suprovince, Luzon (*C. F. Baker*).

Described from a single specimen in my collection bearing Baker's duplicate No. 7657.

EMPHUSIS RUGOSUS sp. nov. Plate 2, figs. 7 and 8.

Black, rough, pubescent, pronotal horns short, stout, extending outward and curving slightly backward and downward; posterior process long, heavy, decurved, reaching almost to tips of tegmina; tegmina bronze with hyaline spot at internal angle and with basal costal region black and punctate; undersurface and legs dark brown.

Head black, roughly sculptured, feebly punctate, sparingly pubescent, subtriangular, about as broad as long; base sinuate; eyes large, brown; ocelli small, amber colored, equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus longer than broad, trilobed, tip rounded.

Pronotum elevated to form a turret about twice as high as wide which bears at the top a pair of suprahumeral horns, these horns short, heavy, flattened dorsoventrally, extending almost directly outward and curving slightly downward and backward;

entire pronotum including the horns black, very roughly sculptured, coarsely punctate, sparingly pubescent; posterior process long, heavy, impinging on tegmina, tectiform, sinuate, base ridged at sides, tip sharp, much decurved, extending almost to apices of tegmina; median carina percurrent; humeral angles prominent; scutellum tomentose, only slightly exposed; a narrow tomentose line extending from base of suprahumeral horns to scutellum.

Tegmina bronze brown, wrinkled, basal and basal two-thirds of costal area black and punctate; hyaline spot at internal angle; veins prominent; five apical and two discoidal cells.

Sides of thorax, undersurface, and abdomen white tomentose; legs brown.

Length from front of head to tips of tegmina, 9 millimeters; width between tips of suprahumeral horns, 5.5.

Type, female.

Locality, Sibuyan (*Baker*).

Described from one specimen, now in my collection, bearing Baker's duplicate No. 19908.

LEPTOCENTRUS MANILAENSIS sp. nov. Plate 2, figs. 9 and 10.

Black, punctate, pilose; scutellum and sides of thorax densely tomentose; eyes red; tegmina smoky hyaline; suprahumeral horns long, sharp, extending almost directly outward and curving backward and slightly downward; posterior process nearly straight, extending to end of abdomen but not reaching tips of tegmina; undersurface and legs black.

Head black, finely punctate, densely pubescent, wider than long, roughly sculptured; base arcuate; eyes large, prominent, red; ocelli small, inconspicuous, yellowish, equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus twice as long as broad, trilobed, extending for more than half its length below inferior margins of cheeks, tip rounded and pilose.

Pronotum black, punctate, pilose; metopidium higher than broad, convex, nearly straight above the head; humeral angles blunt; median carina percurrent; suprahumeral horns long, sharp, tricarinate, extending almost directly outward, curving backward, tips slightly depressed; posterior process arising from top of posterior surface of pronotum, nearly straight, tricarinate, entirely black, sloping downward so that the tip touches tegmina, tip extending as far as end of abdomen but not reaching apices of tegmina; scutellum entirely exposed, densely white tomentose, longer than wide, tip deeply notched.

Tegmina smoky hyaline, wrinkled, veins brown and distinct; base narrowly brown, opaque and punctate; small brown cloud on exterior tip of tegmen; five apical and two discoidal cells.

Sides of thorax densely white tomentose; undersurface, abdomen, and legs black; tarsi dark brown.

Length from front of head to tips of tegmina, 8 millimeters; width between tips of suprahumeral horns, 7.

Type, female.

Described from two females, both collected at Manila in May, 1924, by McGregor. Type in my collection; paratype in Philippine Bureau of Science collection.

This species is apparently close to *L. antilope* Stål, which I am convinced was incorrectly made a synonym of *L. reponens* Walker, by Distant.

LEPTOCENTRUS ARCUATUS sp. nov. Plate 3, figs. 11 and 12.

Black, punctate, pubescent; suprahumeral horns extending outward, slightly upward, and curving sharply backward; posterior process arcuate; scutellum and sides of thorax densely white tomentose; tegmina smoky hyaline; legs black; tarsi brown.

Head black, punctate, densely pubescent, twice as broad as long; base arcuate, eyes large, brown, prominent; ocelli small, brown, inconspicuous, about equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus longer than broad, extending for more than half its length below inferior margins of cheeks, tip rounded and very pilose.

Pronotum black, punctate, pubescent; metopidium about as broad as high; medium carina percurrent; humeral angles blunt; suprahumeral horns long, sharp, tricarinate, flattened dorso-ventrally, extending outward, somewhat upward, and curving strongly backward; posterior process regularly arcuate, tricarinate, tip very sharp, extending slightly beyond end of abdomen but not reaching apices of tegmina; scutellum entirely exposed, about as broad as long, densely white tomentose, tip deeply notched.

Tegmina smoky hyaline, wrinkled; veins brown; base brown, opaque, and punctate; five apical and two discoidal cells.

Sides and undersurface of thorax densely white tomentose; abdomen black; legs black; tarsi brown.

Length from front of head to tips of tegmina, 8 millimeters; width between tips of suprahumeral horns, 6.

Type, female.

Locality, Puerto Princesa, Palawan.

Described from two specimens from the same locality, collected by McGregor, one taken in August and the other in October, 1925. Type in my collection; paratype in Philippine Bureau of Science collection.

TRICENTRUS PANAYENSIS sp. nov. Plate 3, figs. 13 and 14.

Large, black, punctate, pubescent; suprahumeral horns long, slender, extending upward and outward and curving slightly backward; posterior process straight, extending beyond internal angles of tegmina; tegmina bronze with base black and a white tomentose spot showing through behind base; undersurface black; legs dark ferruginous brown.

Head subquadrate, wider than long, black, punctate, densely pubescent with short silvery hairs; base arcuate; eyes large, brown; ocelli dark brown, about equidistant from each other and from the eyes and situated somewhat above a line drawn through centers of eyes; clypeus longer than wide, extending for more than half its length below inferior margins of cheeks, tips truncate.

Pronotum black, coarsely punctate, sparingly pubescent; metopidium about as broad as high, nearly straight above the head; median carina percurrent; humeral angles prominent, blunt; suprahumeral horns slender, triquetrous, about as long as their distance apart at the base, extending outward and upward and curving slightly backward; posterior process nearly straight, very slightly decurved at tip, sharply keeled, impinging on tegmina, tip sharp and extending well beyond internal angles of tegmina.

Tegmina bronze, translucent, wrinkled; base black, opaque, and punctate; a white tomentose spot showing through just behind base; veins brown except over the white area where they are transparent; five apical and two discoidal areas.

Sides of thorax, undersurface, and abdomen black; legs dark ferruginous brown; tarsi ferruginous.

Length from front of head to tips of tegmina, 6.7 millimeters; width between tips of suprahumeral horns, 4.

Type, female.

Type locality, Culasi, Antique Province, Panay.

Described from nine females, all from Panay; seven of these are labeled Culasi, one Flores, and one Tibiao. All were collected by McGregor in May and June, 1918.

Type and three paratypes in my collection; all others in collection of Philippine Bureau of Science.

One specimen is labeled as having been taken on *Acalypha stipulacea*, and another is labeled "In forest, 700 m. elevation."

TRICENTRUS SPININERVIS sp. nov. Plate 3, figs. 15 and 16.

Black, punctate, pubescent; suprahumeral horns extending outward and upward; posterior process straight, sharp, reaching beyond internal angles of tegmina; tegmina smoky hyaline with apical veins bearing spines; undersurface and legs entirely black.

Head subquadrate, broader than long, black, punctate, sparsely pubescent with long golden hairs; base weakly arcuate; eyes large, brown; ocelli glassy, inconspicuous, about equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus longer than broad, extending for half its length below inferior margins of cheeks, tip truncate and pilose.

Pronotum black, coarsely punctate, sparingly pubescent; metopidium a little broader than high, arising almost straight above the head; humeral angles large, prominent, blunt; suprahumeral horns sharp, tricarinate, flattened dorsoventrally, about as long as the distance between their bases, extending outward and upward and curving backward; median carina percurrent; scutellum strongly exposed; posterior process slender, sharp, tricarinate, nearly straight, extending well beyond internal angles of tegmina.

Tegmina smoky hyaline, wrinkled; base black, coriaceous, and punctate; internal apical veins armed with long bristlelike hairs; five apical and two discoidal areas.

Sides of thorax, undersurface of body, abdomen, and femora entirely black; tibiae and tarsi black in one specimen and ferruginous in another.

Length from front of head to tips of tegmina, 6.6 millimeters; width between tips of suprahumeral horns, 4.6.

Type, female.

Described from two females, both collected at Samar by McGregor, one in June and the other in July, 1924. Type in my collection; paratype in collection of Philippine Bureau of Science.

TRICENTRUS MANILAENSIS sp. nov. Plate 3, figs. 17 and 18.

Large, brown, punctate, pilose; suprahumeral horns extending upward and outward; posterior process heavy, sharp, extending beyond internal angles of tegmina; tegmina hyaline with base brown; undersurface and abdomen brown; tarsi flavous.

Head nearly twice as long as broad, brown, punctate, pubescent; base sinuate; eyes large, brown; ocelli amber colored, about equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus twice as long as broad, densely pilose, extending for more than half its length below inferior margins of cheeks, tip truncate.

Pronotum brown, finely punctate, densely pubescent; humeral angles large, prominent, blunt; median carina percurrent; suprahumeral horns extending outward and upward and curving backward, tricarinate, compressed dorsoventrally, sharp; posterior process nearly straight, slender, tricarinate, acuminate, tip slightly darker and extending well beyond internal angles of tegmina but not quite reaching end of abdomen; scutellum broadly exposed.

Tegmina wrinkled, hyaline; base narrowly brown, punctate and slightly pubescent; veins prominent, brown; five apical and two discoidal cells.

Sides of thorax, undersurface, and abdomen brown and densely pubescent; femora brown; tibiae and tarsi flavous.

Length from front of head to tips of tegmina, 7.2 millimeters; width between tips of suprahumeral horns, 5.2.

Type, female.

Described from one specimen, collected at Manila by McGregor in May, 1924. Type in my collection.

TRICENTRUS AEQUICORNIS sp. nov. Plate 4, figs. 19 and 20.

Long, narrow, brown, punctate, pubescent; suprahumeral horns nearly triangular, about as long as the width at base and as the distance between their bases; posterior process slender, sharp, straight, reaching just beyond internal angles of tegmina; tegmina long, narrow, hyaline, bases brown; sides of thorax densely white tomentose, which shows through basal area of tegmina; undersurface of thorax, sides, and undersurface of abdomen brown; legs ferruginous.

Head longer than wide, very dark brown, finely punctate and pubescent; base sinuate, eyes gray-brown; ocelli large, prominent, pearly, about equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus longer than wide, projecting for more than half its length below inferior margins of cheeks, tip truncate and pilose.

Pronotum brown, finely punctate, sparingly pubescent; metopidium broader than high, rising almost straight above the head; humeral angles large, blunt; median carina strongly percurrent; suprahumeral horns short, heavy, acute, nearly triangular, about as long as the width at base and as the distance between their bases, extending outward, upward, and curving slightly backward, tricarinate, flattened dorsoventrally; posterior process narrow, sharp, tip slightly upcurved and reaching just beyond internal angles of tegmina.

Tegmina hyaline, slightly wrinkled; base dark brown, coriaceous and punctate; a prominent white spot showing through basal area behind coriaceous portion; veins prominent, brown; apical limbus narrow; five apical and two discoidal cells.

Sides of thorax densely white tomentose; abdomen dark brown; femora, tibiae, and tarsi ferruginous.

Length from front of head to tips of tegmina, 7.5 millimeters; width between tips of suprahumeral horns, 4.

Type, female.

Described from a single specimen labeled "Baguio, Benguet" and bearing Baker's duplicate No. 16520. Type in my collection.

CENTROTOSCELUS BRUNNEUS sp. nov. Plate 4, fig. 21.

Long, slender, brown, punctate, pubescent; no suprahumeral; hind trochanters armed with teeth; tegmina brown with internal apical margin hyaline; undersurface and legs brown.

Head wider than long, black, densely pubescent with golden hairs; base sinuate; eyes large, brown; ocelli small, pearly, elevated, about equidistant from each other and from the eyes and situated on a line drawn through centers of eyes; clypeus continuing the inferior margins of the cheeks.

Pronotum brown, finely punctate, densely pubescent with golden hairs; metopidium convex, broader than high, an irregular smooth black area on each side at base; humeral angles large, prominent, obtuse; median carina percurrent; scutellum well exposed; posterior process short, heavy, blunt, tectiform, depressed at base, tip darker and not reaching internal angles of tegmina.

Tegmina brown, wrinkled, weakly pilose; base brown, opaque, and punctate; veins brown, prominent; internal apical margin bearing two large hyaline spots separated by a narrow brown line; five apical and two discoidal cells.

Sides of thorax, undersurface, and abdomen very dark brown, almost black; legs light brown; hind trochanters bearing teeth.

Length from front of head to tips of tegmina, 5.5 millimeters; width between tips of humeral angles, 2.5.

Type, female.

Locality, Mount Polis, Ifugao Subprovince, Luzon.

Described from a single specimen, received from Staudinger and A. Bang-Haas and now in my collection. Date and collector unknown.

CRYPTASPIDIA MINUTA sp. nov. Plate 4, fig. 22.

Very small, black, shining, punctate, not pubescent; eyes white; posterior process heavy, tectiform; tegmina black with hyaline tips; undersurface and legs black, tarsi flavous; scutellum entirely hidden.

Head as broad as long, black, finely punctate, not pubescent; base straight; eyes large, white, glassy, translucent, sparkling, prominent; ocelli very small, white, twice as far from each other as from the eyes and situated well above a line drawn through centers of eyes; clypeus obovate, projecting for more than half its length below inferior margins of cheeks, tip rounded.

Pronotum black, finely punctate, not pubescent; metopidium wider than high; humeral angles prominent, blunt; median carina percurrent; posterior process short, heavy, tectiform, arcuate, tip sharp and reaching just to internal angles of tegmina; scutellum entirely covered by pronotum.

Tegmina black and opaque except the tips which are hyaline; base punctate; veins coarse and heavy, not nodulate or pilose.

Sides of thorax, undersurface, abdomen, and legs shining black; tarsi flavous.

Length from front of head to tips of tegmina, 3.2 millimeters; width between tips of humeral angles, 1.7.

Type, female. Male smaller but otherwise similar.

Locality, Puerto Princesa, Palawan.

Described from two females and two males, all collected at the same locality by McGregor in September and October, 1925. Type and one paratype in my collection; allotype and one paratype in Philippine Bureau of Science collection.

SIPYLUS ROTUNDATUS sp. nov. Plate 4, figs. 23 and 24.

Large, color varying from golden brown to black, usually with white tomentose border to pronotum and white tomentose thorax, roughly punctate, sparingly pubescent, white tomentose patch showing through bases of wings; metopidium swollen and con-

vex; humeral angles produced to form stout auriculate horns which extend upward and outward; posterior process reaching just beyond internal angles of tegmina; tegmina smoky hyaline; legs brown.

Head nearly twice as broad as long, black, finely punctate, weakly pubescent; base nearly straight; eyes large, prominent, brown; ocelli large, prominent, brown, about equidistant from each other and from the eyes and situated about on a line drawn through centers of eyes; clypeus subquadrate, pilose, extending for half its length below inferior margins of cheeks.

Pronotum swollen and globose between humeral horns, punctate, pubescent; metopidium strongly convex; median carina weakly percurrent; lateral margins of pronotum and all of scutellum usually but not always strongly white tomentose; humeral angles produced to form short, stout, auriculate horns which extend upward and outward, these horns blunt and flattened dorsoventrally; posterior process strong, tricarinate, keeled, blunt, extending just beyond internal angles of tegmina.

Tegmina smoky hyaline, wrinkled; base black, opaque, and punctate; white tomentose patch showing through wings just behind base; internal margin of tips narrowly brown; five apical and three discoidal cells.

Sides of thorax usually but not always strongly white tomentose; abdomen brown; legs dark brown; tarsi ferruginous.

Length from front of head to tips of tegmina, 7 millimeters; width between tips of humeral horns, 4.7.

Type, female. Male smaller and darker but otherwise similar.

Type locality, Mount Banahao, Luzon.

Described from thirteen specimens, ten females and three males. Twelve are from the Staudinger and A. Bang-Haas collection and bear the locality labels Mount Banahao, Trinidad, Haight's Place, and Imugan, all in Luzon; one was taken by McGregor at Sarai, Laguna Province, on March 19, 1917. This paratype in the Philippine Bureau of Science collection; the type, allotype, and other paratypes in my collection.

GARGARA NIGROAPICA sp. nov. Plate 4, fig. 25.

Near *G. varicolor* Stål, of which it may be another variety, three having been already described. Large, finely punctate, sparingly pubescent; posterior process reaching well beyond internal angles of tegmina; females lemon yellow with tip of posterior process black and with tegmina entirely hyaline; males black with apical third of tegmina clouded with black.

Female.—Head lemon yellow, wider than long, finely punctate, not pubescent, inferior margin rounded; base sinuate; eyes large, red; ocelli very large, yellow with red border, slightly elevated, farther from each other than from the eyes and situated well above a line drawn through centers of eyes; clypeus very small, subtriangular, projecting only slightly below inferior margins of cheeks, tip rounded and pilose.

Pronotum pale lemon yellow, finely punctate, very sparingly pubescent; metopidium sloping, twice as broad as high; median carina obsolete except on posterior process; humeral angles rounded, not prominent; scutellum well exposed; posterior process strong, heavy, tectiform, tip jet black and extending well beyond internal angles of tegmina.

Tegmina entirely hyaline; veins white and indistinct; five apical and two discoidal cells.

Sides of thorax yellow; undersurface of thorax and all of trochanters black; legs and feet yellow; claws black; abdomen yellow.

Length from front of head to tips of tegmina, 5 millimeters; width between tips of humeral angles, 2.4.

Male.—Entirely black; tegmina with base very narrowly black and punctate and with apical third deeply clouded with black. Length, 4 millimeters; width, 2.

Type, female.

Described from six females and ten males, all collected at Puerto Princesa, Palawan, by McGregor in August, 1925. Type and two paratypes in my collection; all others, including allotype, in Philippine Bureau of Science collection.

GARGARA GRACILA sp. nov. Plate 4, fig. 26.

Very small, slender, punctate, pubescent, dark brown; tegmina vinaceous hyaline with base reddish brown and a narrow reddish brown transverse line beyond middle; undersurface and legs dark brown.

Head convex, broader than long, black, finely punctate, pubescent with very short golden hairs; base arcuate; eyes brown; ocelli white, farther from each other than from the eyes and situated about on a line drawn through centers of eyes; clypeus subquadrangular, much deflexed, tip acute.

Pronotum very dark brown, almost black in front, lighter brown behind, finely punctate, sparsely pubescent; metopidium sloping, twice as broad as high, almost black; median carina strongly percurrent; humeral angles prominent, blunt; scutellum

very little exposed; posterior process sinuate, sharp, extending just to internal angles of tegmina.

Tegmina vinaceous hyaline, iridescent; base reddish brown, opaque, and punctate; a narrow reddish brown fascia across the tegmina just below tip of posterior process; veins very indistinct.

Sides of thorax, undersurface, and abdomen very dark brown, almost black; legs dark brown; tarsi light brown.

Length from front of head to tips of tegmina, 3 millimeters; width between tips of humeral angles, 1.5.

Type, female. Male smaller, darker, and with the basal two-thirds of the tegmina entirely black and opaque.

Described from three females and one male, all collected by McGregor; the type female taken at Wright, Samar, July 12, 1924; all others collected at Loquilocon, Samar, May 23, 1924.

Type and one paratype in my collection; allotype and two paratypes in Philippine Bureau of Science collection.

GARGARA FRAGILA sp. nov. Plate 4, fig. 27.

Small, greenish gray, punctate, not pubescent; tegmina entirely hyaline; posterior process slightly sinuate, reaching just beyond internal angles of tegmina; undersurface tinged with brown; legs greenish white.

Head greenish brown, twice as broad as long, finely punctate, not pubescent; base sinuate; eyes large, brown; ocelli white, farther from each other than from the eyes and situated well above a line through centers of eyes; clypeus longer than broad, extending for half its length below inferior margins of cheeks, tip rounded and pilose.

Pronotum greenish gray, finely punctate, not pubescent; metopidium sloping, broader than high, slightly darker above eyes; median carina obsolete except on posterior process; scutellum slightly exposed; posterior process somewhat sinuate, tectiform, tip depressed and reaching just beyond internal angles of tegmina.

Tegmina entirely hyaline; veins weak, white, and indistinct.

Sides of thorax, undersurface, abdomen, and legs greenish brown; pleura and femora slightly tinged with brown.

Length from front of head to tips of tegmina, 4 millimeters; width between tips of humeral angles, 2.

Type, female. Male similar but somewhat smaller.

Described from one female and one male, both collected June 20, 1924, at Loquilocon, Samar, by McGregor. Type in my collection; allotype in Philippine Bureau of Science collection.

GARGARA FASCEIFRONTIS sp. nov. Plate 4, fig. 28.

Small, slender, yellow-brown with dark brown fascia on metopidium, finely punctate, sparsely pubescent; posterior process sinuate, reaching just beyond internal angles of tegmina; tegmina hyaline with a broad brown fascia below tips of posterior process; undersurface dark brown; legs yellow-brown.

Head twice as broad as long, very dark brown, finely punctate, sparingly pubescent; base sinuate; eyes large, yellow-brown; ocelli very small, inconspicuous, yellow, farther from each other than from the eyes and situated about on a line drawn through centers of eyes; clypeus longer than wide, projecting for half its length below inferior margins of cheeks.

Pronotum yellow-brown, finely punctate, sparingly pubescent; metopidium broader than high, a broad brown band on each side of median line extending backward over the shoulders and a dark brown spot over each eye; median carina strongly percurrent; scutellum well exposed; posterior process tectiform, slender, sinuate, tip slightly depressed and extending just beyond internal angles of tegmina.

Tegmina hyaline, wrinkled; base broadly brown, opaque, and punctate; a broad, brown, transverse fascia below tip of posterior process; five apical and two discoidal cells.

Sides of thorax, undersurface, and abdomen dark brown; legs yellow-brown.

Length from front of head to tips of tegmina, 3.8 millimeters; width between tips of humeral angles, 1.7.

Type, female. Male similar but darker.

Described from three females received from Staudinger and A. Bang-Haas and labeled, respectively, Mount Polis, Luzon; Mount Banahao, Luzon; and Ripang, northern Luzon, and one male labeled Imugan, Luzon. Type and paratypes in my collection.

GARGARA NODINERVIS sp. nov. Plate 4, fig. 29.

Small, very finely punctate, pubescent; female yellow, male black; veins of tegmina nodulate and pilose; posterior process arcuate in male, slightly sinuate in female.

Male.—Head broader than long, black, densely covered with white tomentose pubescence; base arcuate; eyes large, prominent, white; ocelli large, prominent, white, conspicuous; clypeus twice as long as wide, projecting for two-thirds its length below inferior margins of cheeks, very pubescent, tip truncate.

Pronotum black, very finely punctate, densely pubescent with grayish hairs; metopidium twice as broad as high, sloping, humeral angles acute; median carina obsolete on metopidium and over shoulders but prominent on posterior process; posterior process heavy, tectiform, arcuate, tip sharp and extending just beyond internal angles of tegmina.

Tegmina hyaline; base black, opaque, punctate, and pilose; a narrow transverse brown fascia below tip of posterior process; veins brown, very pilose and nodulate.

Sides of thorax, undersurface, and abdomen grayish pubescent; legs black; tarsi flavous.

Length from front of head to tips of tegmina, 3.2 millimeters; width between tips of humeral angles, 2.

Female.—Differs from the male in being larger, entirely yellow; posterior process slightly sinuate; tegmina with the transverse fascia less prominent and with the bases yellow. Length, 4 millimeters; width, 2.

Type, male.

Described from a male taken at Pasay Beach, Manila, December 31, 1919, and a female collected at Manila, in April, 1917, both received from McGregor. Type in my collection; allotype in Philippine Bureau of Science collection.

GARGARA GRANULATA sp. nov. Plate 4, fig. 30.

Small, punctate, pubescent; female light brown, male black; veins of tegmina strongly granulate; dorsal line sinuate.

Female.—Head twice as broad as long, dark brown, finely punctate, densely pubescent; base sinuate; eyes large, brown; ocelli small, inconspicuous, pearly, farther from each other than from the eyes and situated about on a line drawn through centers of eyes; clypeus longer than wide, projecting for more than half its length below inferior margins of cheeks.

Pronotum light brown, finely punctate, densely pubescent; metopidium broader than high, a smooth black spot above each eye; median carina obsolete except on posterior process; humeral angles large, blunt; scutellum largely exposed; posterior process short, sinuate, tectiform, tip sharp and extending just beyond internal angles of tegmina.

Tegmina smoky hyaline, wrinkled; base opaque, brown, and punctate; veins decorated with small granules; five apical and two discoidal cells.

Sides of thorax dark brown; undersurface, abdomen, and legs uniformly light brown.

Length from front of head to tips of tegmina, 4 millimeters; width between tips of humeral angles, 2.2.

Male.—Differs from the female in having the entire head, pronotum, undersurface, abdomen, and legs black; tarsi flavous; eyes white; tegmina hyaline except the base which is black, opaque, and punctate. Length, 3.2 millimeters; width, 1.8.

Type, female.

Described from one female and one male from Kolambugan, Mindanao, and a male from Imugan, Luzon. Specimens received from Staudinger and A. Bang-Haas and now in my collection. Date and collector unknown.

GARGARA VARICOLOR Stål. Male.

Stål described three varieties of this species, all of which have been recognized as females. The male has never been described.

In a fine series containing over one hundred specimens of adults and a large number of nymphs of one species sent me by McGregor I find that all of the females belong to one or another of the varieties of *varicolor* described by Stål. Since the specimens were all collected in the same locality on the same date and taken on the same host plant, I assume that the males represented in the series belong to this species. These are all alike and all very near the male of *G. nigroapica*, as described above, but the tegmina are entirely hyaline and the legs vary from black to almost white. In general contour and facies they agree with the females but are slightly smaller.

ILLUSTRATIONS

PLATE 1

- FIG. 1. *Pyrgonota bulbiturris* sp. nov. Lateral view.
2. *Pyrgonota bulbiturris* sp. nov. Dorsal view.
3. *Pyrgonota binodis* sp. nov. Lateral view.
4. *Pyrgonota binodis* sp. nov. Front view.

PLATE 2

- FIG. 5. *Pyrgonota brevifurca* sp. nov. Lateral view.
6. *Pyrgonota brevifurca* sp. nov. Front view of tip of horn.
7. *Emphusis rugosis* sp. nov. Lateral view.
8. *Emphusis rugosis* sp. nov. Front view.
9. *Leptocentrus manilaensis* sp. nov. Lateral view.
10. *Leptocentrus manilaensis* sp. nov. Dorsal view.

PLATE 3

- FIG. 11. *Leptocentrus arcuatus* sp. nov. Lateral view.
12. *Leptocentrus arcuatus* sp. nov. Dorsal view.
13. *Tricentrus panayensis* sp. nov. Lateral view.
14. *Tricentrus panayensis* sp. nov. Front view.
15. *Tricentrus spininervis* sp. nov. Lateral view.
16. *Tricentrus spininervis* sp. nov. Front view.
17. *Tricentrus manilaensis* sp. nov. Lateral view.
18. *Tricentrus manilaensis* sp. nov. Front view.

PLATE 4

- FIG. 19. *Tricentrus aequicornis* sp. nov. Lateral view.
20. *Tricentrus aequicornis* sp. nov. Front view.
21. *Centrotoscelus brunneus* sp. nov. Lateral view.
22. *Cryptaspidia minuta* sp. nov. Lateral view.
23. *Sipylus rotundatus* sp. nov. Lateral view.
24. *Sipylus rotundatus* sp. nov. Dorsal view.
25. *Gargara nigroapica* sp. nov. Lateral view.
26. *Gargara gracila* sp. nov. Lateral view.
27. *Gargara fragila* sp. nov. Lateral view.
28. *Gargara fasceifrontis* sp. nov. Lateral view.
29. *Gargara nodinervis* sp. nov. Lateral view.
30. *Gargara granulata* sp. nov. Lateral view.

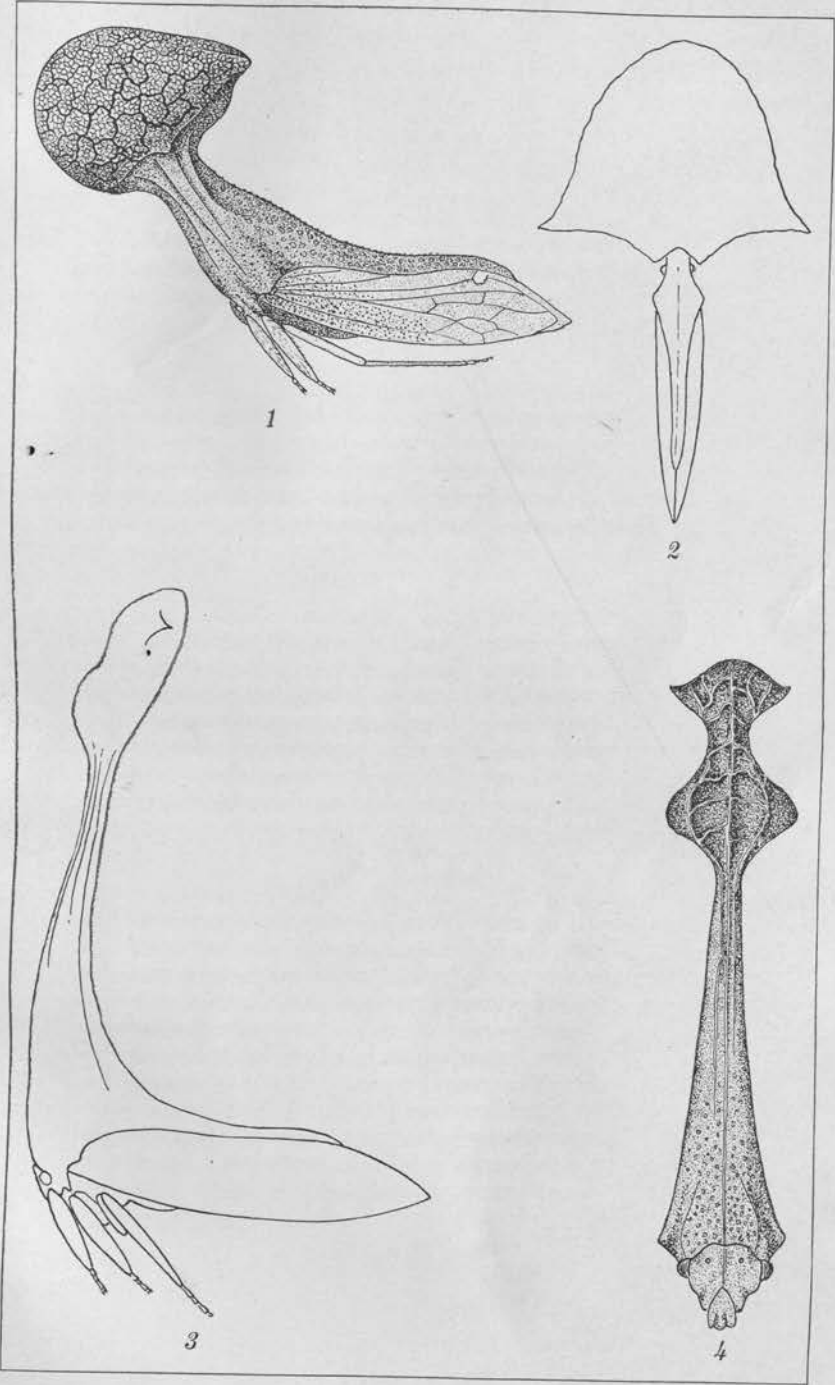


PLATE 1.

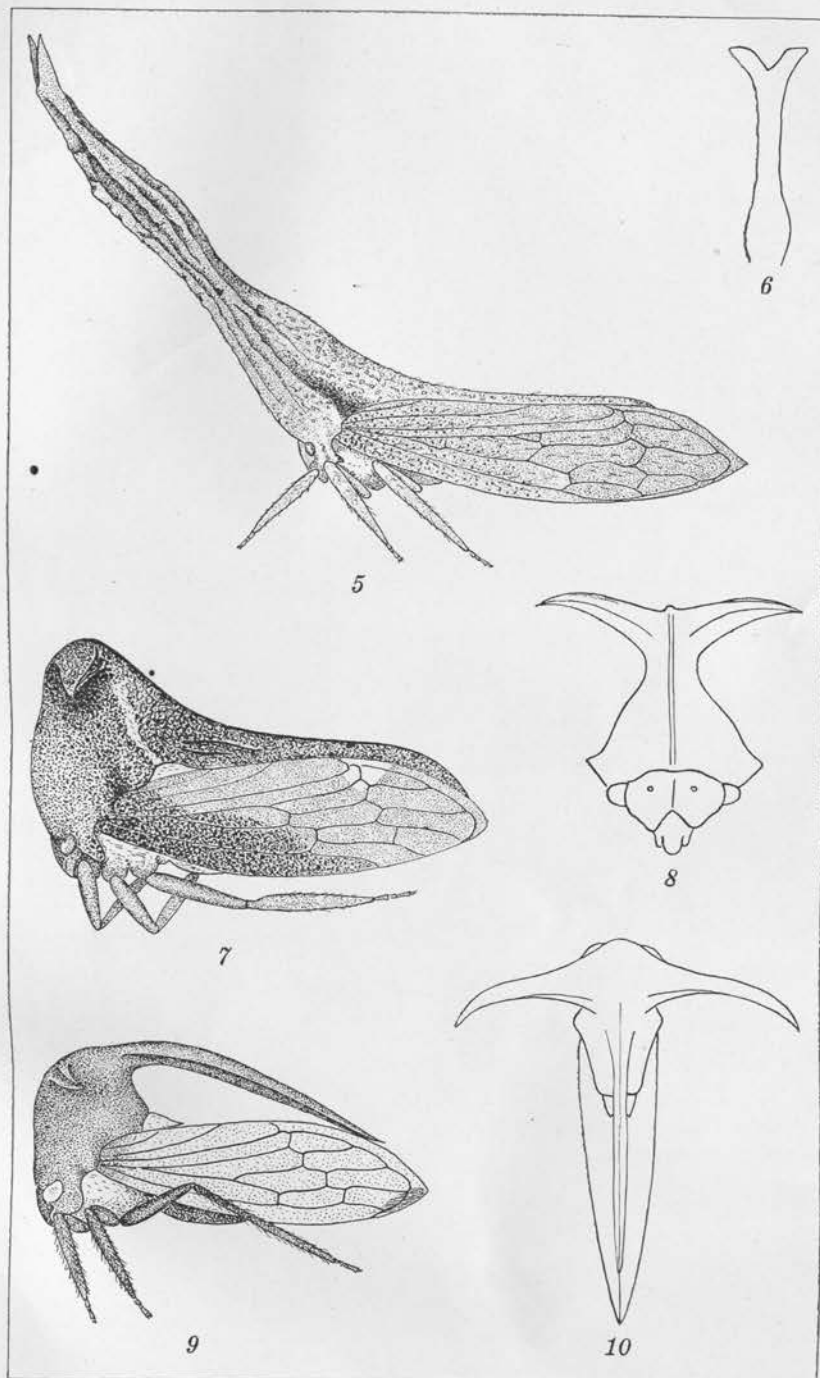


PLATE 2.

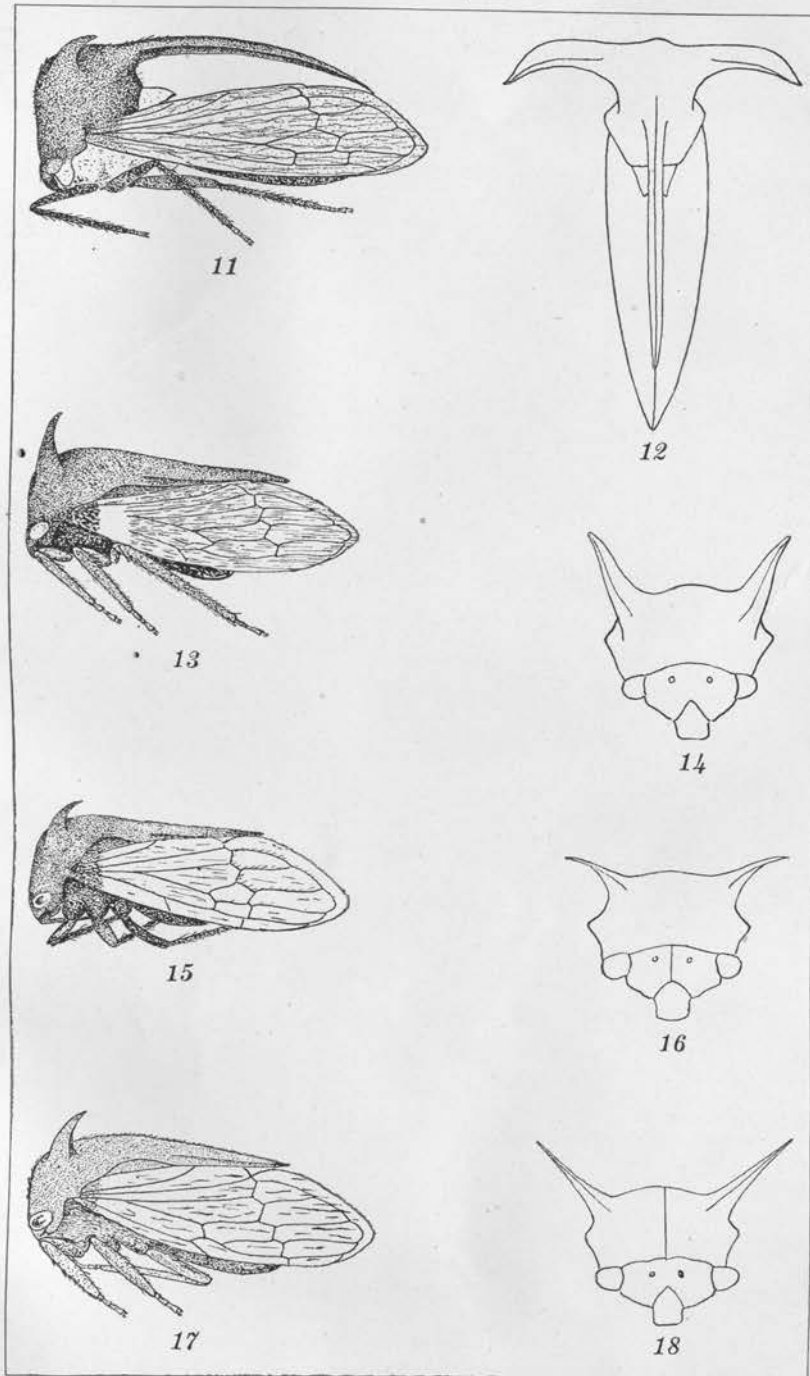


PLATE 3.

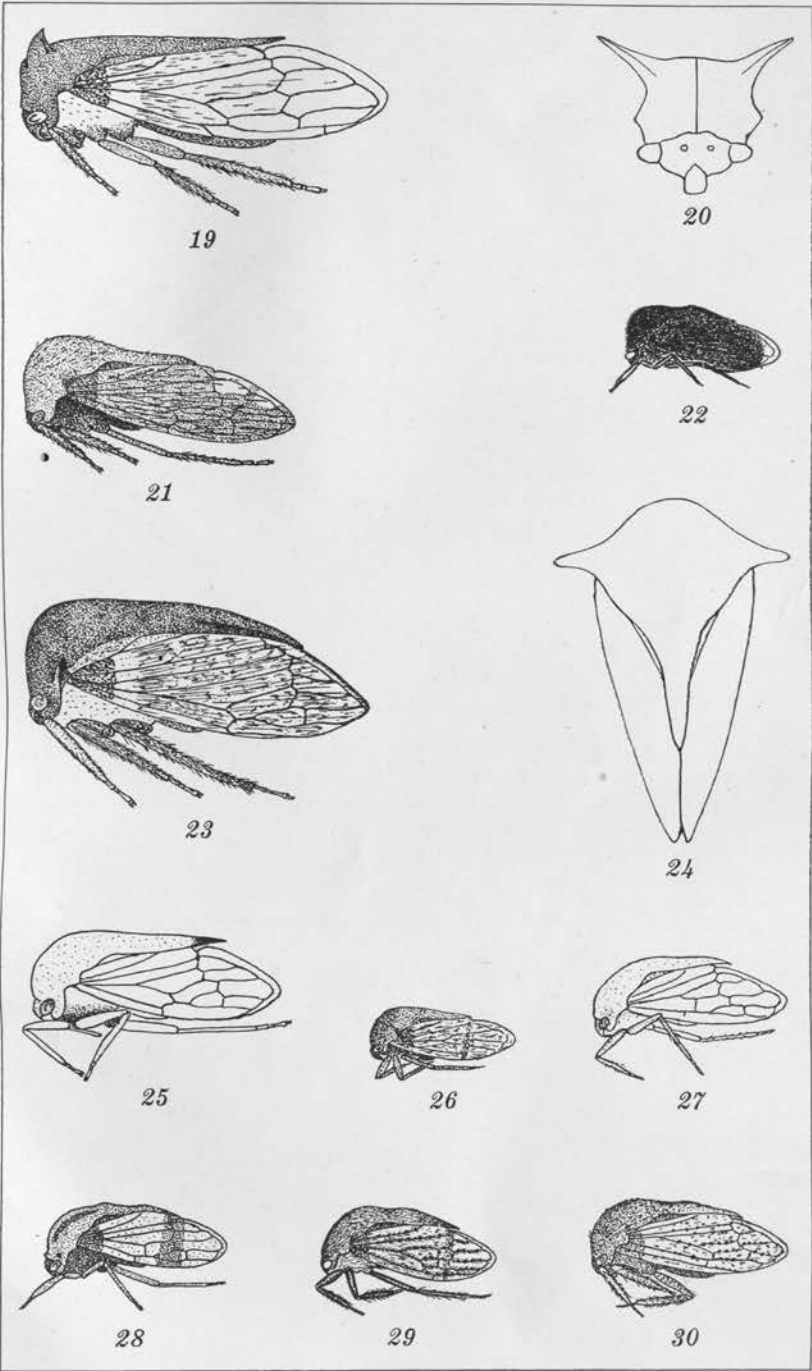


PLATE 4.